AZUSA PACIFIC UNIVERSITY

CRITICAL THINKING INSTRUCTION
IN SELECTED GREATER LOS ANGELES AREA
HIGH SCHOOLS

by

Paul Everett Thomas

A Dissertation Submitted to the

School of Education & Behavioral Studies

in partial fulfillment of the requirements

for the degree Doctor of Education

Azusa, California

May, 1999

AZUSA PACIFIC UNIVERSITY
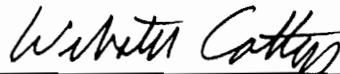
This dissertation written by

Paul Everett Thomas

Has been approved by the

School of Education & Behavioral Studies

in partial fulfillment of the requirements
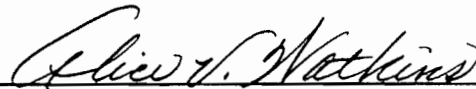
for the degree Doctor of Education

_____
Ted Bartell, PH.D., Committee Chair

_____
Patricia Bonner, Ph.D., Committee Member

_____
Webster Cotton, Ed.D., Committee Member

_____
Alice V. Watkins, Ph.D., Dean
School of Education & Behavioral Studies

DEDICATION

This dissertation is dedicated to my wife, Linette,

whose scholarship and encouragement was a model

and strength for this effort.

ABSTRACT

The purpose of this study was to determine to what extent and under what conditions high school teachers articulate and demonstrate elements of critical thinking in their instruction. The design of the study was to interview high school teachers and to observe them in their classrooms with regard to critical-thinking instruction. Forty teachers were interviewed from six public high schools in the greater Los Angeles area. Thirty-three of these teachers were observed during a class period of instruction.

Some of the information was analyzed quantitatively. Profiles of teachers who were strong and weak in critical-thinking instruction were reported.

This study was a partial replication of the Commission on Teacher Credentialing Study done by Paul, Elder, and Bartell (1997). The results of this study appear consistent with the results of that study. A large percentage of teachers do not articulate a clear understanding of what constitutes critical-thinking instruction. They have little vocabulary to talk about standards of critical thinking, what critical thinking looks like when it is done correctly, how they would reconcile covering content with fostering critical thinking, or what specific critical thinking skills they would like their students to develop.

This study's observation component yielded examples of exemplary practice in critical thinking in high school instruction. Students in honors classes are better served by critical-thinking instruction than those in lower achievement levels. Most teachers who demonstrated exemplary practice in critical thinking did not learn how to do it in their teacher preparation programs.

The major implications of the dissertation are the following:

(1). All teachers need to be educated in the philosophy, vocabulary, standards, intellectual traits, skills, and processes of critical thinking in their preservice and inservice education.

(2). A concerted effort needs to be made to assure that all students, regardless of achievement level, be given the opportunity to learn to think critically.

(3). Critical thinking should become an organizing core for other school reforms.

(4). Textbooks need more critical thinking language and open-ended questions so as to encourage independent cognitive development and reasoning skills in students.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

THE PROBLEM

Background of the Problem

Educators recognize not only the need for students to think critically in learning, but also recognize a gap in instruction that fosters critical thinking. Nickerson, Perkins, and Smith (1985) summarized the problem. "While common sense convinces us of the importance of effective thinking, many researchers and educators are asserting the need for new approaches to education in general and to the problem of teaching thinking in particular" (p.5).

Sizer (1992) distinguishes the educational reform movements of the 1980s from those of the 1990s by stating: "The reform movement [of the 1980s] largely avoided the real world found inside the schools" (p. 11). The 1990s have produced more encouraging indicators and emphasis on the student. "Until we understand clearly just what they should do with their minds and hearts, and what standards they should meet, it is difficult to design a sensible school" (p. 13).

Fraker (1995) in a study of high school freshmen in a Chicago suburb found "two underlying themes as to the reason students lack critical thinking skills: (a) lack of exposure to these skills, such as problem solving and applying learned knowledge to new situations, and (b) students have been 'spoon fed' content and have not had to think for themselves" (p. 9).

Statement of the Problem

In order for a high school student to understand skills learned in a core curricular subject, that student must learn to think through the meaning of that skill. Indeed, thinking itself is a skill which must be learned. Nickerson, Perkins, and Smith (1985) point out that "high-level thinking skills can be improved by training, and it is not safe to assume that such skills will emerge automatically as a matter of development or maturation" (p. 59).

Critical thinking is an activity which can be taught. One can choose what to think about. The obvious nature of these statements would lead one to believe that teacher education and practice would reflect critical thinking skills. Paul, Elder and Bartell (1997), however, in a study of teacher preparation programs in California for the California Commission on Teacher Credentialing (CTC) found that "though the overwhelming majority [of faculty in these teacher preparation programs] (89%) claimed critical thinking to be a primary objective of their instruction, only a small minority (19%) gave a clear explanation of what critical thinking is" (p. 18). In spite of this finding, do high school teachers articulate and demonstrate universally accepted critical thinking standards and intellectual traits in their classrooms?

Or, is Fullan's (1991) conjecture correct? "The emphasis on basic skills and factual knowledge may be preempting the rest of the curriculum, including higher order cognitive skills (e.g., problem-solving and other thinking skills)" (p. 26).

Purpose of the Study

The purpose of this dissertation is to determine to what extent and under what conditions high school teachers articulate and demonstrate elements of critical thinking in their instruction.

Research Questions

The following research questions emerge from this purpose statement:

(1). To what extent do high school teachers engage in reasoned discourse in their instruction?

(2). To what extent do high school teachers articulate and demonstrate universally accepted intellectual standards for critical thinking in their instruction (e.g., relevancy, accuracy, precision, depth, sufficiency, logic, clarity, consistency)? See Paul (1997a), pp. 3-27.

(3). To what extent do high school teachers articulate and demonstrate analytic inferential skills in their instruction (e.g., formulation and assessment of: purposes, questions, inferences and interpretation, information, concepts, assumptions, implications and consequences, point of view)? Paul (1997b) describes these skills as the elements of reasoning.

(4). To what extent do high school teachers articulate and demonstrate a fundamental value orientation that includes intellectual traits and dispositions in their instruction (e.g., intellectual humility, courage, empathy, integrity, perseverance, faith in reason, and fair-mindedness)? See Paul (1995, pp. 316, 317).

(5). How do high school teachers report that they foster critical thinking skills in their students?

(6). Under what philosophic, practical, and preparatory conditions do high school teachers utilize standards and elements of reasoning in their instruction?

Significance of the Study

Kennedy (1991) found that

Virtually all of the blue-ribbon commissions that have studied education in the last decade have argued that we need a new and better kind of teaching: teaching that challenges students more than our current methods do, that expects more of students, that demands higher-order thinking from them, that prepares them for the workplace of tomorrow. (pp. 661, 662)

She cites findings from research under five categories. First, students do not do well at thinking and reasoning. They may compute well, but they have trouble with more complex mathematical operations. They can write and use good grammar, but they have trouble defending their points of view. Second, textbooks do not focus on "big ideas, offer no analysis, and pose no challenging questions" (Kennedy, 1991, p. 662). There is instead a vast amount of information without the attendant interrelatedness of the facts. Third, core curricular subjects are presented for covering material rather than for deeper understanding. There is simply not enough instructional time in a school year for many teachers to cover all of the bits of information they feel must be covered. Fourth, classes are often very predictable in sequence of activity. This practice lessens the excitement of discovery. The fault is not just with the teachers. It lies with textbooks, with

4

school organization, and school policy as well. Fifth, teachers teach the way they were taught. If mathematics and language were learned as procedural and grammatical rules, that's how they are apt to be taught. These findings indicate a serious void in high school instructional practice.

On the other hand, some research indicates a presence in schools of instructional practice which engenders critical thinking. Rooney (1992) demonstrated, in a study of data that spanned a one year period, the effect of technology on the critical thinking skills of students in the Hueneme, California School District. He reported that "[statistically] significant differences [were reflected] at the .05 level of confidence between the pretest and posttest scores in all of the subtests, as well as the total test of the Cornell Critical Thinking Test [Ennis and Millman, 1982] as measured by the total scores (N=101) of the seventh and eighth graders [at two junior high schools] who took part in the testing program" (p. 9). Over the study period, the intervening treatment between pretest and posttest was exposure to the use of computers in the instructional program. In addition, two other comparable school district results were used as comparison groups to establish user norms. One district was in a central school system in upstate New York; another was in a large Southern California city. It is assumed by this researcher that the other two school districts were not exposed to the same technology as the Hueneme group. "Percentile rankings were based upon the mean raw scores and reflected an approximate 40 percentile gain between pretest and posttest" (p.11), in the Hueneme group, i.e., a ranking of the 40th percentile on the pretest was related to a ranking of the 80th percentile on the posttest. It is not

5

immediately clear to this researcher why the use of computer technology should lead to increases in critical thinking. Might this result have been due to entirely different instructional aspects that occurred simultaneously with the use of computers? Nonetheless, perhaps this study shows that students begin to think more critically in measurable ways when they are exposed to computer technology.

Not just technological instruction needs to change, however. Goodlad, Sirotnik, and Overman (1979) concluded that in the typical high school class period of 57 minutes, "barely 5% of the instructional time is spent on direct questioning (i.e., questions which anticipate a specific response like 'yes,' 'no,' 'Columbus,' '1492,' etc.). . . . Not even 1% of the time is devoted to open questions, calling for student skills beyond the first or second levels of the cognitive or affective taxonomies" (pp. 8,9).

In a more recent study, Muskin (1990) found that "although response discussion occurs in 93 of the 228 [high school history] lessons [she observed], and in 22 of the classrooms, most of these instances are extremely brief and sporadic, usually constituting less than 15% of oral instructional time" (p. 11).

Paul (1997b) argues that one of the problems of current reforms in education is their disintegrative, divergent nature. The solution is some unifying structure that can be an organizing core to integrate these good ideas. Paul believes the critical-thinking instruction would do that.

Particularly in an environment of great confusion about whether basic skills or higher level thinking skills are to prevail, the wise teacher will understand the importance of critical thinking. An important teacher goal is teaching a student how

6

to do something. An even more important goal is teaching a student how to figure out a problem should the memorized facts be forgotten. If California teachers are doing a good job of critical-thinking instruction, it may be in spite of their teacher preparation courses. If they are not doing a good job of critical-thinking instruction, perhaps critical thinking could become an organizing core for many reforms.

Definitions of Terms

The following definitions will be used for terms relevant to this study:

Critical Thinking "A unique kind of purposeful thinking in which the thinker systematically and habitually imposes criteria and intellectual standards upon the thinking" (Paul, 1995, p. 21).

"This concept of critical thinking is multi-dimensional, including the intellectual (logic, reason), the psychological (self-awareness, empathy), the sociological (the socio-historical context), the ethical (involving moral norms and evaluation), and the philosophical [ontological] (the meaning of human nature and life)" (Paul et al., 1997, p. 1).

Rational Discourse Oral communication that utilizes principles of good reasoning. Examples of irrational discourse would be unqualified opinions or claims, illogical arguments, statements made that show poor judgment, nonsequential and unconnected thoughts.

Intellectual Standards Universally accepted norms to determine whether the

7

thinking is correct. Principles to judge the quality of thinking. Such standards would include clarity, accuracy, precision, relevance, depth, breadth, logic (Paul & Nosich, 1995, p. 131).

Sufficiency The quality of completeness. Has the issue been examined enough to make meaning and answer the question?

Consistency "To think, act, or speak in agreement with what has already been thought, done, or expressed; to have intellectual or moral integrity" (Paul, 1995, p. 524).

Clarity The state of being easy to understand.

Accuracy The state of being "free from errors, mistakes, or distortion" (Paul, 1995, p. 521).

Precision "The quality of being accurate, definite, and exact" (Paul, 1995, p. 546).

Relevance "Bearing upon or relating to the matter at hand" (Paul, 1995, p. 549).

Depth A measure of profoundness. Does the thinker probe the issues sufficiently to explore the question so that meaning can be made and new insight discovered?

Breadth A measure of the extent of scope. Does the thinker have a wide enough scope to have data sufficient to answer the question?

Logic The use of correct reasoning in determining "the set of rational considerations that bear upon the settlement of any question or set of questions" (Paul, 1995, p. 540).

Intellectual Traits Universally accepted virtues of thinking that prevent

8

critical thinking from obfuscation, prejudice, narrow-mindedness. Such traits would include intellectual humility, intellectual honesty, fair-mindedness (Paul, 1995, p. 57).

Elements of Reasoning The building blocks of thinking. Such elements might include goals of thinking, questions, point of view, assumptions, inferences, and implications (Paul, 1995, p. 529).

Analytic Inferential Skill The ability to break the whole into its parts and then to draw conclusions based on the truth of previous knowledge.

Inference Conclusion drawn from assumptions and data.

Implication What necessarily follows based upon the inferences that have been made. (i.e., if [inferences], then [implications]).

Organization of the Remainder of the Study

The remainder of the study will consist of the following. Chapter II will review the literature on critical thinking in general, review the Commission on Teacher Credentialing Study for which this study is a partial replication, and review the literature on critical-thinking instruction, particularly at the high school level. Chapter III will detail the research design and methodology of this study. Chapter IV will present the data collected. Chapter V will present the findings, conclusions, and recommendations of this study. The References list works cited in the study. The Appendices contain interview and observation instruments.

9

CHAPTER II

REVIEW OF THE LITERATURE

The scope of this chapter is to review the literature with regard to critical-thinking instruction. The topics discussed are the following: search procedure; theories of critical thinking; universal elements, standards, and traits of critical thinking; the Commission on Teacher Credentialing Study; and high school critical-thinking instruction.

Search Procedure

A search plan similar to that described by Wehmeyer 1995, (pp. 10-CHE-p. 1-5) was used for this chapter. The following search terms were generated using the Library of Congress Subject Headings and the Thesaurus of ERIC Descriptors: critical think/ and high school; critical think/ and (high school and instruct/); critical think/ and (highschool and instruct/) and (literature review or meta-analys/or metaanalys/). The most productive search string was critical think/ and high school using ERIC on Compuserve which yielded 534 hits.

Dissertation Abstracts using the Compuserve ERIC database yielded 154 hits with critical think/ and high school.

The Schrag (1992) article, "Critical Thinking" in the *Encyclopedia of Educational Research* yielded a wealth of information including Nickerson,

Perkins, and Smith (1985) and Baron (1987).

Conversations with individuals in the field of critical thinking produced many books and journal articles useful to this study. Publications of the Foundation for Critical Thinking and attendance at the 1997 National Academy Training for Trainers: Teaching Critical Thinking Strategies to Colleagues, Sonoma State University, were extremely useful. The Foundation for Critical Thinking and the National Academy provided a framework to talk about critical thinking in a way that this researcher found nowhere else.

Theories of Critical Thinking

John Dewey (1933), gave a succinct definition of critical thinking. While he did not use many of the current terms for critical thinking, such as *critical thinking* itself, he overviewed many of the universally accepted elements and standards of the discipline. "Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends constitutes reflective thought" (p. 9). Further in his study, Dewey defined inference, a commonly used term relative to critical thinking, as "this process of arriving at an idea of what is absent on the basis of what is at hand" (p. 95). Dewey classified the functions of reflective activity into five categories: suggestions, a problem to be solved, the development of leading ideas or hypotheses, the development of suppositions (as a part of the function of inference), and the testing of the hypothesis through action (p. 107). Baron (1987,

11

p. 155, 157) recognize in Dewey's approach the educational values of student application, reflection, and interpretation.

Several researchers refer to Benjamin Bloom's (1956) *Taxonomy of Educational Objectives: The Classification of Educational Goals* as a framework for instruction in critical thinking (Goodlad & Klein 1974; Nickerson, Perkins, & Smith 1985; Costa 1985; McPeck 1990). Bloom's work classified the goals of an education system. He wanted to provide educators with a more precise vocabulary for communicating about curriculum and evaluation (Bloom, 1956, p. 1). This framework for discussing the educational process was divided into the following parts: knowledge, comprehension, application, analysis, synthesis, and evaluation. Each of these categories was presented with an explanation of meaning and function and ways to test for student mastery.

Paul (1995) found Bloom's (1956), as cited in Paul, (1995) analysis "very rewarding reading" p. 218, particularly the sections on analysis, synthesis, and evaluation. Paul has concluded, however, that teachers who depend solely on Bloom for learning how to think critically tend only to ask and answer questions of analysis, synthesis, and evaluation. This view, according to Paul "is seriously misleading. According to most advocates of critical thinking, no neat set of recipes can foster critical thinking in students" (p. 218).

Paul's (1995) most important problem with Bloom's (1956) taxonomy is that "knowledge is not something that can be given by one person to another. It cannot simply be memorized out of a book or taken whole cloth from the mind of another. Knowledge, rightly understood, is a distinctive construction by the

12

learner" (p. 222).

Nickerson et al. (1985, pp. 147-309) give full descriptions of many approaches to critical thinking. All of these approaches have some commonalties: elements, intellectual traits, and standards. They all try to organize in some unique way what critical thinking is. The authors identify three major groups in their approaches to critical thinking.

One group deals with a cognitive operations approach. Adams' et al. (as cited in Nickerson et al.,1985, pp. 181-187) Project Intelligence, for instance, speaks of intellectually demanding tasks and inferential use of information. Ehrenberg and Sydelles' (as cited in Nickerson et al., 1985, pp 176-181) BASICS, (Building and Applying Strategies for Intellectual Competencies in Students) learning strategies begin with inferring attributes, meaning, causes and effects. Gagne and Klausmeier (as cited in Nickerson et al., 1985, pp. 169-172) speak of improving learning in a program called SAPA (Science: A Process Approach) which emphasizes eight processes of science: observing, using space–time relationships, using numbers, measuring, classifying, communicating, predicting, and inferring. The Skills Essential to Learning Project (as cited in Nickerson et al., 1985, pp. 172-176) produced a series of sixty 15-minute video programs called ThinkAbout. ThinkAbout is organized around thirteen basic reasoning skills: finding alternatives, estimating and approximating, giving and getting meaning, collecting information, classifying, finding patterns, generalizing, sequencing and scheduling, using criteria, reshaping information, judging information,

13

communicating effectively, solving problems. Guilford's (as cited in Nickerson et al., 1985, pp. 161-168) SOI (Structure of Intellect) Program focuses on operations (e.g., ability to make judgments), contents (e.g., numbers and notions), and products (e.g., classes defined by common properties).

A second group of critical thinking experts, according to the researchers, takes an heuristics oriented approach—that is, learning by discovery. Schoenfeld (as cited in Nickerson et al. 1985, pp. 195-203), for example, speaks of drawing a diagram or examining special cases for analysis, exploration of equivalent or modified problems, and verifying the solution by testing for sufficiency of data. Wheeler (as cited in Nickerson et al., 1985, pp. 203-206) reports the use of discovery criteria in attempting to evaluate the effectiveness of critical-thinking instruction. Such criteria as using intuitions; listening, reacting, and observing accurately; and recognizing assumptions were measured.

Piagetian-based programs make up the third group of critical thinking approaches cited by the researchers. These approaches focus on the student's preferred method of learning, stages of learning, and learning cycles. Nickerson et al. (1985) ask,

> Are these Piagetian-based programs effective on the whole? It is difficult to say. The quantitative data that exist, which are relatively sparse, are not very compelling. The qualitative data, of which there are considerably more, are very difficult to fit together into a single coherent picture, but are generally positive. (p. 245)

Schon (1983, p. ix) argues that reflection-in-action is susceptible to a kind of rigor that is both like and unlike the rigor of scholarly research and controlled experiment. Competent practitioners usually know more than they can say. They

14

exhibit a kind of knowing-in-practice, most of which is tacit. Perhaps most people would call that intuition, which is not listed traditionally among the elements or traits of good reasoning.

Giroux (1994) in a defense of what has been called the Critical Pedagogy Movement, which is strongly aligned with the theories of Paulo Freire, said, "At the core of what we call critical thinking, there are two major assumptions that are missing. First, there is a relationship between theory and facts; second, knowledge cannot be separated from human interests, norms, and values" (p. 201). In this statement, Giroux criticizes the teaching of critical thought, especially in social studies. This approach teaches students to analyze dispassionately and develop logically a theme that flows from the data under study. Giroux and other scholars would recognize that the way information is contexted, selected, arranged, and sequenced is connected to the beliefs and values of the one doing the analysis. Frame of reference becomes important in addition to elements of reasoning more traditionally used, such as those of Bloom (1956).

Scholars for generations have taught that critical thinking is not an activity that is done in a vacuum. There are social and philosophical contexts associated with critical thinking. Unrau (1997) states, "When we reflect on a claim, we don't bring our knowledge and beliefs to bear in isolation. We always activate these in a social context" (p. 23).

In Plato's *Republic*, Book VII, "The Allegory of the Cave," Socrates tells a "parable to illustrate the degrees in which our nature may be enlightened or unenlightened" (Allen, 1991, p. 224). People are chained in a cave and can only

15

see shadows of objects on the wall. They cannot see themselves or one another. They only see reflections on the wall and hear echoes off of the wall. Then, they are freed and rise out of the cave into the light. The movement is physically painful but also intellectually painful as they move from "unwisdom," the world of illusion, to the real world. Suddenly, they could relate their experience to each other. They were asked to believe that what they thought was real was only illusion. These people then returned to the cave able to see infinitely better.

Socrates applied his parable to education. "We must conclude that education is not what it is said to be by some, who profess it, as if they could put sight into blind eyes" (Allen, 1991, p. 227). The implications for critical thinking are that wisdom and thinking about reality must be done with others. There is also a philosophical human dimension.

As Cotton (1997) wrote, "It was our ability to think, question, wonder, listen, reason, be in dialogue with others that enabled us to understand the meaning of our existence and let our being unfold in its unique way" (p. 1). Cotton believes there is a difference between training and education. Training is designed to produce functionality and effectiveness. Education is self-evaluation and analysis in a social–philosophical context. We are brought into being in and for relationship with others. One could be trained to function in isolation. It takes education to produce sight for the blind cave dwellers of Socrates' parable (Allen, 1991). Critical thinking is found in the context of education. Education is found in the context of what it means to be a human being.

McPeck (1990, pp. 19-21) advocates that thinking is always about some particular thing or subject. Thinking is never taught in a vacuum. Further, he

states that "an effective thinker in one area is not necessarily an effective thinker in all other areas" (p. 20). Finally, McPeck believes that a critical thinker must think for oneself. He is, in other words, an active learner, not a passive one. Such reflection on critical thinking opens avenues to new approaches to the elements, standards, and traits of reasoning. The next section provides a discussion of Richard Paul's (1997a, 1995) interesting paradigm for talking about the effectiveness of reasoning, one which becomes the basis upon which this study rests.

Universal Elements, Standards, and Traits of Critical Thinking

Elements

Paul (1995) identifies ten elements "that are present in all thinking about any problem" (p. 22). They are presented in question format:

- What is the *purpose* of my thinking?
- What precise *question* am I trying to answer?
- What *point of view* am I operating within?
- What *information* am I using?
- How am I *interpreting* that information?
- What *concepts* or ideas are central to my thinking?
- What *conclusions* am I coming to?
- What am I taking for granted, what *assumptions* am I making?
- If I accept the conclusions, what are the *implications*?
- What would the *consequences* be, if I put my thought into action?

Paul (1997a) writes about the value of these elements of reasoning.

Once we progress from thought which is purely associational and undisciplined, to thinking which is conceptual and inferential, thinking which attempts in some intelligible way to figure something out, in short, to reasoning, then it is helpful to concentrate on what can be called "the elements of reasoning. (pp. 3-7)

Ennis (1996, p.4), on the other hand sees only six basic elements in critical thinking. He uses the acronym FRISCO to help the student remember them. They are focus, reasons, inference, situation, clarity, and overview. Paul (1997a, p. 3-26, 27) categorizes clarity as a standard rather than an element of reasoning.

Standards

In making a case for intellectual discipline, Elder (1997b) states that "it is impossible to envision an intellectually rigorous academic environment devoid of standards. Without them there would be no means of assessing the intellectual performance of students, no criteria by which to judge their work" (p. 1).

Paul (1997a) defends the use of standards:

Universal intellectual standards are standards which must be applied to thinking whenever one is interested in checking the quality of reasoning about a problem, issue, or situation. To think critically entails having command of these standards. To help students learn them, teachers should pose questions which probe student thinking, questions which hold students accountable for their thinking, questions which, through consistent use by the teacher in the classroom, become internalized by students as questions they need to ask themselves. The ultimate goal, then, is for these questions to become infused in the thinking of students. (chapter 3, p. 26)

Paul (1997a, chapter 3, pp. 26, 27) lists the following universal standards as the most important: clarity, accuracy, precision, relevance, depth, breadth, logic.

Traits

Paul (1995) makes a statement about intellectual character traits:

18

At the highest level of development, the mastery of reasoning entails the development of a variety of interrelated character traits: intellectual humility, intellectual courage, intellectual perseverance, intellectual civility, intellectual integrity, intellectual curiosity, intellectual responsibility, intellectual autonomy, fair-mindedness, and faith in reason. (pp. 316,317)

Perhaps one would ask whether Paul (1997a, 1995) is outside the mainstream in his structuring of reasoning into universal elements, standards, and traits. Concerning elements, one would only need to ask whether critical thinking could take place without a consideration of purpose, question at hand, assumptions, implications, and so forth. Concerning standards, one need only ask if unclear, inaccurate, imprecise, irrelevant, shallow, narrow, illogical thinking would be considered good reasoning. Concerning the traits, one need only ask whether an arrogant, fearful, indolent, dishonest, disinterested, irresponsible, enmeshed, unfair, and unreasoning person would likely posses the characteristics of a critical thinker. Certainly in all of the previous authors reviewed, the elements, standards, and traits stated by Paul are either implicit or explicit.

The Commission on Teacher Credentialing Study

Paul, Elder, and Bartell (1997) in a study for the Commission on Teacher Credentialing, State of California, of 101 education faculty and 39 subject-matter faculty in teacher education institutions in California, concluded the following from interview questions essentially the same as those proposed in Appendix A:

(1)   Though the overwhelming majority (89%) claimed critical thinking to be a primary objective of their instruction, only a small minority (19%) gave a clear explanation of what critical thinking is. Furthermore, according to their answers, only 9% of the respondents were clearly teaching for critical

thinking on a typical day in class.

(2) Though the overwhelming majority (78%) claimed that their students lacked appropriate intellectual standards (to use in assessing their thinking), only 73% considered that students learning to assess their own work was of primary importance, only a very small minority (8%) enumerated any intellectual criteria or standards they required of students or gave an intelligible explanation of what those criteria and standards were.

(3) While 50% of those interviewed said that they explicitly distinguish critical thinking skills from traits, only 8% provided a clear conception of the critical thinking skills they thought were most important for their students to develop. Furthermore the overwhelming majority (75%) provided either minimal or vague allusion (33%) or no allusion at all (42%) to intellectual traits of mind.

(4) When asked how they conceptualized truth, a surprising 41% of those who responded to the question said that knowledge, truth and sound judgment are fundamentally a matter of personal preference or subjective taste.

(5) Although the majority (67%) said that their concept of critical thinking is largely explicit in their thinking, only 19% elaborated on their concept of thinking.

(6) Although the vast majority (89%) stated that critical thinking was of primary importance to their instruction, 77% of the respondents provided limited or no conception of how to reconcile content coverage with the fostering of critical thinking. [Paul believes that content is thinking; thinking is content. cf. Paul, 1997b, p. 2-8f.].

(7) Although the overwhelming majority (81%) felt that their department's graduates develop a good or high level of critical thinking ability while in their program, only 20% said that their departments had a shared approach to critical thinking, and only 9% clearly articulated how they would assess the extent to which a faculty member was or was not fostering critical thinking. The remaining respondents had a limited conception or no conception of how to do this.

(8) Although the vast majority (89%) stated that critical thinking was of primary importance to their instruction, only a very small minority clearly explained the meanings of basic terms

20

in critical thinking. For example, only 8% clearly differentiated between an assumption and an inference, and only 4% differentiated between an inference and an implication.

(9)   A very small minority (9%) mentioned the special and/or growing need for critical thinking today in virtue of the pace of change and the complexities inherent in human life. Not a single respondent elaborated on the issue.

(10)   In explaining their views of critical thinking, the overwhelming majority (69%) made either no allusion at all, or a minimal allusion, to the need for greater emphasis on peer and student self-assessment in instruction.

(11)   From either the quantitative data directly, or from minimal inference from those data, it is clear that a significant percentage of faculty interviewed (and, if representative, most faculty):
  • do not understand the connection of critical thinking to intellectual standards.
  • do not specify intellectual criteria and standards.
  • inadvertently confuse the active involvement of students in classroom activities with critical thinking in those activities.
  • do not provide an elaborated articulation of their concept of critical thinking.
  • do not provide plausible examples of how they foster critical thinking in the classroom.
  • do not name specific critical thinking skills they think are important for students to learn.
  • do not explain how to reconcile covering content with fostering critical thinking.
  • do not consider reasoning as a significant focus of critical thinking.
  • do not think of reasoning within disciplines as a major focus of instruction.
  • do not specify basic structures essential to the analysis of reasoning.
  • do not give an intelligible explanation of basic abilities either in critical thinking or in reasoning.
  • do not distinguish the *psychological* dimension of thought

21

from the *intellectual* dimension. (pp. 18, 19)

This researcher was allowed to listen to eight randomly selected taped interviews from the Commission study (Paul, Elder, and Bartell (1997). It was clear that even with such a minimum sample, that the Commission on Teacher Credentialing (CTC) researchers obtained from the interviewees vague answers with limited or no conception of their own philosophies of critical thinking.

The present study is a partial replication of the CTC study (Paul, Elder, and Bartell, 1997), with high school teachers and their instruction of students being the focus. The next step is to study high school critical-thinking instruction and to interview and observe high school teachers regarding critical-thinking instruction to see whether the gaps in critical-thinking instruction portrayed for teacher educators extend to the teachers themselves.

High School Critical-Thinking Instruction

In General

Christensen (1993) surveyed 341 elementary and high school teachers in the Omaha Public Schools regarding critical thinking skills the teachers thought they developed in their students. The survey consisted of six headings with 40 questions. Six research questions were addressed. There were 252 teachers who responded, 89 elementary and 163 high school. The teachers were asked how most of their students' time was spent in their classrooms; nine options included small group work, partner/pair activities, lecture/listening activities, worksheets, and

22

reading. For most of the survey, a five-point Likert scale was used with categorical tags for each response ranging from *always* to *never*. Another question asked the teachers which skills they felt were necessary for student achievement. Possible answers included research skills, memorization skills, note taking, problem solving, and organizing. The Spearman correlation was used for comparisons. The ANOVA and *t* tests were used to find differences. The results indicated that the teachers reported using critical thinking in their classrooms. There was no statistically significant difference between elementary and high school teachers in their reporting of the use of critical thinking in their classrooms or of their perceptions of the kinds of critical thinking skills that were necessary for their students to have. There was no statistically significant difference between teachers' reported frequency of use of critical thinking skills in relation to teaching experience or educational level. There was a statistically significant difference between the elementary and high school teachers in amount of classroom time reportedly spent on critical skills; elementary teachers reported spending more time than high school teachers.

There are three major weaknesses in the Christensen study (1993). The first is in treating ordinal data as if it were interval data and using parametric *t* tests and the ANOVA instead of *chi-square* analyses. The second and more serious weakness, which Christensen herself recognized, is that no standards were applied to determine whether the students were actually thinking critically in those classrooms. In fact, Christensen implied that there were no clear and reliable

23

assessment tools for critical thinking. Finally, no interviews of teachers or direct classroom observations were done, a weakness which Christensen also acknowledged.

Riley (1991), in a study of four classes of twelfth grade home economics students in Madison, Wisconsin, tested the impact of higher level questions by the teachers on critical thinking abilities and achievement test scores. A three and one-half week unit on aging was developed specifically for this study. Riley's experimental questions that were based on Bloom's (1956) taxonomy, were used throughout the course for the experimental group, while the control classes "were taught in the traditional manner." (Riley, 1991, p. 56). Two classes (32 students) composed the control group. Two classes (44 students) received the experimental treatment. The Cornell Critical Thinking Test, and a teacher-made achievement test were used to measure the differences between the control classes and the experimental classes. Pre- and posttests were given to both groups. There were no males in the control group; however, there was a mixture of males and females in the experimental group.

Since a statistically significant difference was found between the "change in pre- and posttest scores for the experimental and control groups" (p. 64), Riley (1991) examined the mean scores. The mean score for the males in the experimental group was lower on the Cornell post-test than on the pretest. The mean score for the females in the experimental group was higher on the Cornell posttest than on the pretest. The mean score for the control group (all females) was lower on the Cornell posttest than on the pretest. Overall, the experimental group's

Cornell pretest mean score was higher than that of the control group, and the posttest score for the experimental group was also higher than the control group's score.

It should be noted that the one statistically significant difference in the scores was due to the increased performance of the females, not the males, in the experimental group. It should further be noted that the GPA for the experimental group was lower by 0.62 than that of the control group. Riley (1991) contrasted her findings with those of Beseda (1974), Kwak (1980) and Cohen (1973) as cited in Riley (1991), who demonstrated few positive gains in critical thinking due to the use of teachers' questioning techniques.

Riley's (1991) findings for the teacher-made achievement test indicated an increase in mean score for all groups between pretest and posttest; however, the difference between pretest and posttest mean scores on the teacher-made achievement test was not statistically significant.

Two major weaknesses in the Riley (1991) study involved the difference in gender between the experimental group and the control group and the use of questions as teaching tools. Nothing in the study indicated how the questions were used. If they were simply questions at the end of lessons each day, their use may have been negligible, even counterproductive. If, however, the students were engaged in genuine reflection, the questions may have been useful. No standards were given as to whether students were thinking critically or not. Just because they were exposed to questions does not mean they thought about them.

25

Language Arts

Hendricks, Newman, and Stropnik (1995) in an action research project measured the use of higher order thinking skills to improve reading comprehension. The population for the study was a group of seventh and eighth grade students in a suburb of Chicago. Based on teacher observations, anecdotal notes and standardized test (Iowa Test of Basic Skills) scores, all of the students exhibited inadequate skills in the area of reading comprehension resulting in poor academic achievement. A pretest and posttest of the Nelson Reading Skills Test, Form 3, Level C was given. Over a six-month period students in targeted classrooms used three processes designed to improve reading comprehension through critical thinking techniques: questioning strategies, journal entries that addressed comprehension, and graphic organizers to reflect prior knowledge. The researchers concluded that the students showed a marked improvement in both word meaning and reading comprehension. There does not appear to have been a control group to determine whether the critical thinking methods were the cause of improvement or some other reason. The only standard for assessment was the Nelson Reading Skills Test. It was noted that the population did not remain fixed throughout the six-month period.

Math

Schoenfeld (1982) wrote about four themes of mathematics education as he then perceived them.

- I believe that most instruction in mathematics is, in a very real sense, deceptive and possibly fraudulent.
- The mathematics education community has isolated itself from psychological and other research in problem solving.
- The world of problem solving is small and possibly incestuous.
- There is a difference between my choices of problems and my notion of expert, and the standard choices of problems and notion of "expert" (pp. 27-31).

Some of Schoenfeld's (1982) concerns centered around the controversy of teaching mathematics as a useful discipline versus teaching it as an aesthetic discipline. He favors the aesthetic side. "In my opinion the single most important reason to teach mathematics is that it is an ideal discipline for training students how to think" (p. 32). Further, Schoenfeld refines his meaning of thinking. "To examine what accounts for expertise in problem solving, you would have to give the expert a problem for which he does not have access to a solution schema" (p. 32). Schoenfeld criticized mathematics education for teaching students schema and key words for solving problems rather than fostering critical thinking skills. He saw a great danger in confusing proficiency and expertise when assessing student mathematics performance.

Perhaps those who are working within a constructivist framework of mathematics education are addressing some of Schoenfeld's (1982) concerns. Lester (1996), a former second-grade teacher, after making some constructivist changes in her teaching style exulted about the use of critical thinking in her classroom.

I have a different sense of what mathematics is . . . I spend my time thinking about what it is that I really want the children to learn and I create a question or a problem that will engender the construction of

that concept. I am a questioner . . . I am a listener. . . .The children
and I share the responsibility of creating this learning environment.
We all question. We all listen. (p. 145)

Schifter (1996), another constructivist mathematics teacher and consultant

says, "Through mathematics lessons that challenge teachers at their own levels of

mathematics competence, they can both increase their mathematical knowledge and

experience a depth of learning that is, for many of them, unprecedented . . .

mathematics as an activity of construction" (p. 81).

Paul (1995), on the other hand, adds a word of caution. "There is nothing

wrong with focusing attention on the need of students to 'construct meaning' but it

must be underscored that the mere construction of meaning, as such, is not a

significant achievement, since it is done as much by Archie Bunker as by Einstein"

(p. 59). While Paul sees the construction of meaning as a much more critical

thinking activity than rote memorization, he pleads for reasoned construction of

meaning—meaning that can be measured over against standards of reasoning.

Social Studies

Tsai (1996) interviewed and observed 11 junior and senior high teachers in

Taiwan. These teachers taught combinations of geography, history, and citizenship

and were almost evenly distributed over public and private junior and senior high

schools. The purpose of the study was to find out whether Taiwanese social

studies teachers were familiar with critical thinking and whether they used critical

thinking in their social studies instruction. The data gathered were qualitatively

analyzed for patterns. Together with a personal background questionnaire, the

28

interview consisted of 24 questions. The questions were read to the participants in Chinese. Both questions and answers were audio-taped. Two interpreters aided in the translation of the tapes. Following the interviews, video-taped classroom observations were made.

Three limitations of the study were noted by Tsai (1996). They were translation errors, lack of classroom observations of all participants, and location of schools in which participants taught—all in the city of Taipei. Tsai used a check sheet for identifying the rating of teaching methods in promoting critical thinking. However, the rating scale listed only teaching methods. Nothing in the check sheet indicated that the observer was looking for critical standards. That is, how did the observer know that the students were actually thinking critically while doing these activities? One appendix lists some commonly used critical thinking skills in social studies, such as relevancy, bias, and consistency, but there was nothing in the findings that showed the researcher was looking for these standards being demonstrated or required by the teacher. However, textbooks and Ministry of Education guidelines were analyzed for critical thinking components. Tsai's conclusion was that although most participants thought they used critical thinking in their social studies classrooms, they were not familiar with the formal definitions of critical thinking and its strategies. Further, the Ministry of Education guidelines did not require teachers to teach critical thinking.

Kemp (1988) did a study of the effects of instruction in forming generalizations on high school students' critical thinking in world history. The

29

study was of two classes in a large suburban high school in Texas. Pretests and posttests were given both classes using the Cornell Critical Thinking Test. In addition, both classes were given a pre- and posttreatment essay assignment in which they stated and defended a generalization. Both classes were given a teacher-made pretest and a posttest on the Renaissance and Reformation. One class received explicit instruction, that is, a "teaching method that incorporates clearly defined task requirements, specific guidelines for task completion, teacher modeling, substantial guided practice along with feedback, and provisions for self-monitoring; student-centered instruction" (p. 6). The other class received traditional instruction that is, "exclusive control of instruction by the teacher who directs student activities with little or no opportunity for students to select learning tasks or take part in decisions" (p. 6). Both classes were taught by the same teacher. The treatment consisted of two weeks of instruction dealing with the Renaissance and Reformation. The study found that there was a statistically significant difference between the groups on the quality and quantity of students' writing. However, students taught with explicit methods did not score significantly higher on the teacher-made test or on the Cornell Critical Thinking Test.

Muskin (1990) in a paper presented to the American Educational Research Association studied the pressure that most social studies curricula create for teachers to cover material. Such coverage leads to low student retention of knowledge. The instructional practices of 12 U.S. history teachers in 6 schools and 24 classes were examined. Classroom observations were made, and evaluations of each minute of class time were coded and recorded according to instructional and non-instructional

formats. Muskin concluded that

> Sample teachers, on average, spent anywhere between 63 and 85% of classtime on instruction. Most of this time is spent in oral instruction, although some teachers spend a substantial amount of time in AV [audio-visual], and a smaller number of teachers devote a significant amount of time to seatwork activities. (p. 16)

Muskin noted that only six of the teachers listed critical-thinking instruction as one of their key goals (p. 6).

> In many of the classrooms serving a lower proportion of college-bound students, the press for content coverage takes the form of limited expectations for student homework and concomitant coverage of the content through teacher lecture, seatwork, AV, and structured recitation. (p. 17)

Muskin (1990) concludes,

> Increasing student opportunity to learn, especially the opportunity to learn critical thinking skills, may well involve changing some teaching environments, and insuring that all teachers have the requisite content and pedagogic knowledge/skills to choose and implement the goals and activities that will bring us closer to the ideal social studies classroom envisioned by reformers. (p. 21)

Science

Julyan and Duckworth (1996) point out that "knowing the scientific words used to explain a phenomenon does not necessarily reflect an understanding of what the words describe. . .Pure and simple explanation is not so pure or simple" (pp. 55, 56). These researchers add their names to the growing list of constructivist adherents after the tradition of Jean Piaget. They state that, "It is important. . .to make a distinction between providing students with experiences and supporting students' developing understanding" (p. 57). This support takes time and effort both by the teacher and by the student, and it can be frustrating especially when

31

students often "prefer to gain their knowledge through transmission rather than construction. . .[yet,] science-as-vocabulary requires less effort on the part of both the teacher and the student, but also provides fewer rewards" (p. 68).

Paul, Binker, Martin, and Adamson (1995) see students who think like scientists developing a critical understanding of both science process and content. They believe that science teaching often "over-emphasizes narrow mastery of the conventional explanations and techniques of established science. Sometimes this means asking students literally to memorize facts, definitions, diagrams, and so forth" (p. 199). These researchers do not see that kind of instruction as the most powerful that could be employed. Instead,

> This is a key point in a critical approach to student inquiry: scientific thinking is not a matter of running through a set of steps called "the scientific method." Rather it is a kind of thinking in which we move back and forth between questions, answers to those questions, and experiments which test those answers. (p. 200)

What students bring to science in terms of their own assumptions and preconceptions is of great importance in fostering deep understanding. As Richard Paul (1997b) said, "To learn a new idea, one must talk it, write it, and think it into his system."

This chapter has overviewed the major theories of critical thinking that impacted this study. The linkage was made to current scholarship regarding universally accepted elements, standards, and traits of critical thinking. An overview was given of the recently completed *California Teacher Preparation for Instruction in Critical Thinking: Research Findings and Policy Recommendations* done by the California Commission on Teacher Credentialing (Paul, Elder, and

32

Bartell,1997) and how those findings affect the current study. Finally, a review of literature for high school critical thinking was given with special emphasis on the four core curricular areas from which teachers will be chosen for this study. The next chapter describes research methodology and procedure.

CHAPTER III

RESEARCH METHODOLOGY AND PROCEDURE

Type of Research

The type of research for this study is primarily qualitative in the form of narrative analysis of data, but it also includes quantitative aspects. It should be noted that this is a partial replication of *California Teacher Preparation for Instruction in Critical Thinking: Research Findings and Policy Recommendations* done by the California Commission on Teacher Credentialing (1997). This study focuses on high school teachers and their instruction of students.

Research Design

Description

The qualitative research design for this study included interviews, observations, and follow-up questionnaires. Forty teachers were interviewed; 33 teachers were observed; and 12 teachers were asked to complete a follow-up questionnaire. However, for reasons of generalizability, only the teachers which were randomly sampled were included in the statistical analysis of interviews and observations, i. e., 31 of the total group of 40 interviewees and 27 of the total group of 33 observees (see Appendix C).

Teachers were interviewed, if possible face-to-face, if not, by telephone. Most of the interviewees were observed in their classrooms. Choice of randomly selected teachers for observation was based upon two criteria: (a) self-reported use of certain instructional strategies that appear to encourage critical thinking, and (b) evaluations of teacher interviews as determined by the Coding Sheet for Open-Ended Questions in Appendix A of this study. The classroom observations were written up as narrative analyses of teachers who demonstrated exemplary practice in critical-thinking instruction as well as those who demonstrated weak profiles in critical-thinking instruction.

Some of the data were analyzed quantitatively. Summations and percentages were calculated for results of the interview and observation data. These findings are summarized in table format in chapter IV. One-Way ANOVAs and 2-Sample Independent t Tests were summarized in tables in chapter V for background independent variables on selected dependent variables. The Pearson and Spearman correlational analyses were used to analyze the relationship between variables.

Twelve teachers were selected who articulated and demonstrated exemplary practice in critical thinking in the interviews and in the observations. Follow-up questionnaires were sent to these teachers to determine what influenced their exemplary critical-thinking instruction. A summary of the results is given in Table 14, chapter V.

Rationale

Concerning the narrative analyses, Yin (1993) states that "the major rationale for using this method [case study design] is when your investigation must cover both a particular phenomenon and the context within which the phenomenon is occurring" (p. 31). In such an instance, there may be more explanatory variables than cases. To discover under what conditions high school teachers articulated and demonstrated elements of critical thinking in their instruction, it was considered necessary to study the context in which the instruction occurred, (e.g., classroom practice, administrator or department chair philosophy, or school culture). In this study, for teachers who self-reported the use of certain instructional strategies that appeared to encourage critical thinking, an additional dimension was added. The individual teacher's perceived use of critical thinking was combined with classroom demonstration of instruction. A second reason for using observation-based methods was to cross-validate the information received from the larger number of interviews.

Summary tables are used to present interview and observational data. Qualitative and quantitative research data relevant to each research question are given below. The interview question numbers refer to those in Appendix A.

(1). To what extent do high school teachers engage in reasoned discourse in their instruction? The data for this question came from interview Questions #2, 3, 4, 5, 7, 8, and from classroom observations.

(2). To what extent do high school teachers articulate and demonstrate universally accepted intellectual standards for critical thinking in their instruction

(e.g., relevancy, accuracy, precision, depth, sufficiency, logic, clarity, consistency)? The data for this question came from interview Question #6 and from classroom observations.

(3). To what extent do high school teachers articulate and demonstrate analytic inferential skills in their instruction (e.g., formulation and assessment of: purposes, questions, inferences and interpretation, information, concepts, assumptions, implications and consequences, point of view)? The data for this question came from interview Questions #1, 2, 4, 5, 7, 8, and from classroom observations.

(4). To what extent do high school teachers articulate and demonstrate a fundamental value orientation that includes intellectual traits and dispositions in their instruction? (e.g., intellectual humility, courage, empathy, integrity, perseverance, faith in reason, and fair-mindedness). The data for this question came from interview Questions #1, 2, 3, and from classroom observations.

(5). How do high school teachers report that they foster critical thinking skills in their students? The data for this question came from interview Questions #2, 3, 4, 6, and from classroom observations.

(6). Under what philosophic, practical, and preparatory conditions (such as the structural–causal influences of experience and education, classroom and school environments, support system, and administrative–central office influence) do high school teachers utilize standards and elements of reasoning in their instruction? The data for this question came from interview Questions #1, 2, 3, 4, 5, 6, 9, and from

37

classroom observations.

Interpretation of the interview information involved coding (Appendix A). The researcher assigned "vagueness," "misconception," "wanders from the question," or "contradiction in the answer" to each response in the interview for which any of those categories applied.

A second section of the coding instrument (Appendix A), evaluated areas which the interviewee did or did not mention. A Likert scale value (1 = *not mentioned*; 6 = *elaborated*) is recorded for each of the following items: basic skills of thought, important intellectual traits of mind, reasoning within the subject, an emphasis on problem solving, the special need for critical thinking today, and the need for greater emphasis on peer and student self-assessment.

The coding instrument is a partial and modified version of the one used in the CTC study mentioned earlier and provides a rubric for organizing and assessing the information in as objective a way as possible. The researcher was aware that this coding was subjective, but the work was done based upon what was recorded rather than his own biases. The interviewee may have had different experiences and studied from different theorists in the field than the author has. The interviewee may have knowledge of critical thinking skills that the researcher has not yet learned. However, the researcher coded the responses based upon what was said by the interviewee without placing value judgements on experiences, theorists, or skills. The researcher believes that the coding is indicative of the responses.

Population and Sample

Description

The population for the study were public high school teachers from the greater Los Angeles area. The sample selected to study from that population were 106 of those teachers (see Appendix C).

Two separate sampling procedures were used, a random selection and a purposive selection (see Appendix C). (a) Random Selection. Teachers were randomly selected from six major greater Los Angeles area high schools. These teachers were selected from lists provided by the administration of each of the high schools. The teachers work primarily in the four core curricular areas: language arts, math, social studies, and science. The initial contact with each teacher was a return-requested letter with an informed consent form enclosed for the school districts that required it. For those who responded positively, the letter was followed up with a phone call requesting an interview appointment. (b) Purposive Selection. The purposive selection consisted of teachers nominated from the schools by administrators as good critical-thinking instructors. These teachers were interviewed and observed in their classrooms. All but one of the six high schools provided purposive sample nominees, but not all of the purposive sample nominees agreed to participate (see Appendix C).

Rationale

This population was chosen because of geographic proximity to the

researcher and because of a desire to extend the CTC study of teacher preparation to include data collection on practicing teachers themselves, specifically, teachers of high school language arts, math, science, and social studies.

Instrumentation

Description

During September and October, 1998, teachers who agreed to participate were interviewed, if possible face-to-face, if not, by telephone, using a modified version of a portion of the instrument that was used for teacher education faculty in *California Teacher Preparation for Instruction in Critical Thinking: Research Findings and Policy Recommendations* conducted by the California Commission on Teacher Credentialing (1997). See Appendix A. Teachers from each of the six high schools were interviewed. In one high school only a single randomly selected teacher was willing to participate. Most of the interviewees were observed in their classrooms.

Selected classroom observation tools, such as Pathwise, and protocols suggested by Baron (1987); Costa and Garmston (1994); Jackson, Boostrom, and Hansen (1993); and Paul (1998) were used to study the teachers' demonstration of critical-thinking instruction. See Appendix B.

Pathwise by Educational Testing Service (1995) provides a method to assess teachers for critical-thinking instruction in classroom settings. Four questions are to be reflected upon by the assessor:

(1). Does the teacher recognize and use opportunities to help

students extend their thinking?

    (2). Is the teacher able to use the current content appropriately as a springboard to independent, creative, or critical thinking?

    (3). Does the teacher challenge students' thinking in ways relevant to their background knowledge and experiences?

    (4). Does the teacher structure specific learning activities that encourage students to extend their thinking? (Domain C, Criterion C3, p. 31)

Teachers are scored on a six-point scale ranging from 1.0 to 3.5 with the following scoring rubric:

1.0 The teacher discourages students from thinking independently, creatively, or critically.

1.5 Above level 1.0, but below level 2.0.

2.0 The teacher encourages students to think independently, creatively, or critically in the context of the content being studied.

2.5 Above level 2.0, but below level 3.0.

3.0 The teacher uses activities or strategies that are specifically designed to actively encourage students to think independently, creatively, or critically about the content being taught.

3.5 Above level 3.0. (p. 31)

Baron (1987, pp. 226-231) describes criteria teachers can use to determine the effectiveness of their critical-thinking instruction. These criteria were modified by this researcher for use as classroom observation tools. They are framed in the form of questions. Does the teacher use wide-angle (whole class) as well as telephoto lenses to assess whether students are thinking critically? Does the teacher appear to evaluate student thinking continually throughout the class? Does the teacher look for sustained efforts at critical thinking? Does the teacher look for transfer to other situations on the part of her students? Does the teacher look for side effects of her students' thinking? Does the teacher encourage metacognition on the part of her students? Does the teacher use a variety of approaches to assess

student thinking? What are the students doing during class discussions? (i.e., Are

they asking their own questions, challenging one another, piggybacking on one

another's comments, viewing themselves as scholars, asking for justification and

clarification?)

Further questions about use of classroom time are suggested by Costa

(1985). "Six rather temporal dimensions have been identified in teachers' thinking.

Every instructional thought, event, occurrence, or situation can be defined in terms

of sequence, simultaneity, synchronicity, duration, rhythm, and temporal logic" (p.

220). Are the instructional events ordered? Are multiple objectives handled at the

same time? Does it all come together effectively? Is time allocated effectively to

produce critical thinking?

Jackson et al. (1993) advocate a two-step process for classroom

observations:

> We can distinguish two phases of the process: one descriptive, the
> other reflective. The descriptive phase takes place while sitting in
> the classroom . . . and consists of jotting down whatever strikes one
> as noteworthy, without worrying unduly at the time about its
> potential . . . significance. Later, those notes can be expanded,
> preferably that same day or soon after, in order to fill in some of the
> detail that is still remembered but was not jotted down. It is then
> that the reflective phase begins. (p. 46)

Jackson et al. describe the reflective phase as thinking, talking, and writing time.

Richard Paul (personal communication, July 6, 1998) suggested the

following questions for observation instruments:

- Are students encouraged to clarify the question?

- Are students encouraged to gather relevant data?

- Are students encouraged to reason to a valid solution?

- Are there discussions of the assumptions?

- Are the implications of conclusions discussed?

- Have students entered accurately into alternative viewpoints?

- Are students encouraged to discriminate and identify what they

    don't know as well as what they do know? (Intellectual humility)

- Does the classroom involve intellectually challenging work that

    requires students to persevere? (Intellectual perseverance)

- Are students expected to achieve a high degree of precision and

    accuracy in their reasoning? (Intellectual responsibility)

- Do students feel secure and free enough to honestly acknowledge

    their inconsistencies? (Intellectual integrity)

- Are students encouraged to treat each other alike without reference

    to their own feelings or interests? (Fair-mindedness)

- Is there an atmosphere of thinking within a discipline (e.g.,

    mathematical thinking)?

- Were there any references during the classroom observation to

    universally accepted intellectual standards for critical thinking

    (e.g., relevancy, accuracy, precision, depth, sufficiency, logic,

    clarity, consistency)? If so, which?

Of these tools, the Pathwise material has been used for a number of years as

an assessment tool by administrators for teachers. Baron, Costa, Jackson, and

Paul are all well recognized researchers in the field of critical thinking. Paul's observation questions are based on the interview questions used in the well-validated CTC study (Paul et al., 1997).

Rationale

Since this is a partial replication of the CTC Study, the same interview protocol was used in a modified format. One additional activity, which because of the size of the CTC Study was not practicable, was observation in classrooms of several teachers. Paul et al. (1997) indicate this limitation of their study. "The resources available to conduct this study did not permit direct observation of actual teaching practices at the university level. We are thus limited to the self-reported information provided by the faculty respondents" (p. 18).

Observation is a commonly used tool for evaluating the effectiveness of instruction (Jackson et al., 1993; Baron & Sternberg, 1987; Goodlad et al., 1974). Without observation in the classrooms of some of the teachers, the researcher would only have self-reported data by the teachers as to their attitudes and practices in critical-thinking instruction.

Costa (1985) points out the limited value of using only standardized tests in assessing critical-thinking instruction without observing students in the classroom.

> Assessing thinking through the exclusive use of standardized,
> paper-pencil techniques is inadequate. Each teacher should look for
> indicators of growing intelligence. Most teachers neither need nor
> use standardized tests to determine the effectiveness of their teaching
> for thinking. Significant problem-solving behaviors are displayed
> and can be observed daily if we know how to recognize them. (p.
> 290)

Data Collection

Audio tapes were made of all of the interviews. These tapes were used in later transcriptions, either in part or in whole, to quote or summarize. Soon after each interview, the coding section of the interview instrument (see Appendix A) was completed. These coding questions ranked interviewee responses on a three-category scale from little or no conception to elaborated conception. Then, to summarize these coding results, six additional questions were completed which determined whether the interviewee did or did not mention key components of critical-thinking instruction. Summary tables are presented to demonstrate the coding of the interviewee responses. Data gathered through the researcher's responses to questions concerning classroom observations (see Appendix B) were reported with narrative analysis and summarized quantitatively in tables.

Data Analysis

The study is largely presented and analyzed descriptively. Strong and weak profiles of critical-thinking instruction are presented in chapter IV. Quantitative approaches were also used to test for statistically significant differences and to analyze the relationships between variables. One-Way ANOVA was used to determine differences between achievement levels of classes observed on selected dependent variables. These dependent variables were chosen because of their specificity and summarizing content. For those variables that yielded nonparametric

data the Kruskal-Wallis Test was used. A 2-Sample Independent t Test was used

to compare means for selected dependent variables on the interview data and on

observation data. The Mann-Whitney U Test was used for nonparametric data.

Pearson and Spearman correlational analyses were used to analyze the relationship

between variables. Analysis of the data in chapter V is done by presenting answers

to each of the research questions.

CHAPTER IV

PRESENTATION OF DATA

The purpose of this study is to determine under what conditions high school

teachers articulate and demonstrate elements of critical thinking in their instruction.

Forty teachers were interviewed from six public high schools in the greater Los

Angeles area. Thirty-three of these teachers were observed during a class period of

instruction. The high schools selected were all large high schools with a rich

diversity of ethnic mix. The size of the high schools' student population ranged

from 1,800 to 4,500. No two of the high schools were in the same city.

Participants for the samples in this study came from four different school districts.

Four of the schools were in Los Angeles County. One was in Orange County.

One was in San Bernardino County.

Organization of Data

The data gathered are presented in ten tables. Fifty-two variables are

addressed either with answers to interview questions or observational data. For full

text of the interview and observation questions see Appendices A and B. The

remainder of the data is presented in a format similar to that used by Paul et al.

(1997, pp. 21-31.)

Background Characteristics

Seven questions compose the background characteristics. The first indicates whether the case was randomly selected or purposively selected at the recommendation of a school administrator. Some cases were both randomly selected and purposively selected because the random selection was done first in some of the high schools. When the administrator's recommendations were received, some of the teachers had already been selected randomly. In one case a teacher heard about the study from a colleague and asked to be included. That case is listed as volunteer.

Other background characteristics included gender, subject taught, number of years of experience, whether the teacher entered education from another field, and demographics of observed classes (see Table 1).

Conceptualization of Critical Thinking

Table 2 reports the responses to five of the interview questions. Data in this table and in all of the succeeding tables in this chapter are reported only on the *random* and *both* samples (N = 31 interviews, 27 observations; see Appendix C). In order to provide greater generalizability, *Purposive* and *volunteer* samples are not included in these statistical analyses. These questions allowed teachers to articulate their concepts of critical thinking and the skills and standards they viewed to be most important in developing critical thinking in their students. Two questions measured teacher knowledge of three critical thinking concepts:

assumption, inference, and implication.

Table 1

<u>Respondent Background Characteristics</u>

Description	Tally
Random sample or purposive sample	Random 25; Purposive 8; Both 6; Volunteer 1
Gender	Male 18; Female 22
Subject taught	L.A. 13; Math 9; Social Studies 9; Science 9
Experience (years)	Mean 16; Median 14
Did you enter education from another field?	Yes 19; No 21
Observed class type	Basic 6; General 14; Honors or AP 13
Observed class size	Mean 30; Median 32; Minimum 12; Maximum 42

<u>Note.</u> N = 40 interviews, 33 observations; see Appendix C.

Half the teachers were able to elaborate some concept of critical thinking,
usually based on Bloom's Taxonomy, and most frequently only with analysis and
synthesis mentioned. However, when the teachers were prompted to state what
intellectual standards they would use to distinguish whether or not these processes
were being done critically versus uncritically, few teachers could articulate any clear
standards. Only nine of the teachers could articulate clearly a personal conception
of intellectual standards. The table indicates a relatively low degree of
conceptualization of critical thinking concepts.

49

Table 2

Conceptualization of Critical Thinking

Interview question	Degree of conceptualization
Concept of critical thinking (i1)[a]	Little or none 1; Limited 14; Elaborated 16
Critical thinking skills most important for your students (i4)	Little or none 4; Limited 14; Elaborated 13
Your personal conception of intellectual standards (i6)	Little or none 6; Limited 19; Elaborated 6
Difference between assumption and inference (i7)	Little or none 6; Limited 12; Elaborated 13
Difference between inference and implication (i8)	Little or none 18; Limited 8; Elaborated 5

Notes: N = 31 interviews, *random* and *both* only (see Appendix C). [a]The notation i1, i2, etc. refers to interview question #1, #2, etc. See Appendix A.

Teacher Reported Daily Classroom Activity

Table 3 reports the results of interview questions in which teachers said what they did in a typical day to foster critical-thinking instruction and how they reconciled covering content with having time for critical thinking. While more than half of the teachers could not articulate what they did to foster critical thinking in a typical day, more than half had an elaborated conception about the issue of covering content versus critical-thinking instruction. They believed that critical thinking was at least part of what they were doing in instruction. Many, in fact, said they thought critical thinking *was* the content.

Table 3

Teacher Reported Daily Classroom Activity

Activity	Degree of conception
Description of typical day in class that fosters critical thinking (i2)	Little or none 2; Limited 17; Elaborated 12
Reconciling covering content with fostering critical thinking (i3)	Little or none 4; Limited 9; Elaborated 18

Note. N=31.

Observations of Daily Classroom Teacher Activity

Tables 4 and 5 report observation data related to what the teachers actually did as observed in the classroom. Table 4 reports findings from the Pathwise observation questions, and Table 5 reports findings from the Baron questions.

The Pathwise protocol, which was used as an observation guide, yielded a consistent average finding. From the rubric, given below, these findings fell between teachers encouraging students to think independently, and so forth. on the one hand, and teachers actually using activities and strategies that were specifically designed to actively encourage students to think independently on the other hand. When this researcher tried to apply the Pathwise protocol to the teachers in the study, he found the questions to be rather global and difficult to discriminate between categories of the rubric. As an example, very few teachers were found to discourage students' critical thinking for the entire class period. Perhaps the

51

questions need more specificity, such as frequency, duration, and intensity of the observed activity.

The Pathwise questions were based on the following rubric:

1.0 The teacher discourages students from thinking independently, creatively, or critically.
1.5 Above level 1.0, but below level 2.0.
2.0 The teacher encourages students to think independently, creatively, or critically in the context of the content being studied.
2.5 Above level 2.0, but below level 3.0.
3.0 The teacher uses activities or strategies that are specifically designed to actively encourage students to think independently, creatively, or critically about the content being taught.
3.5 Above level 3.0 (Educational Testing Service, 1995, p. 31).

Table 4

Teacher Daily Classroom Activity

Description of activity	Degree of activity (mean)
Does teacher help students extend their thinking? (path1)	2.6
Current content as a springboard to critical thinking? (path2)	2.5
Students challenged relative to their experience? (path3)	2.5
Learning activities wherein students extend their thinking? (path4)	2.7

Note. Pathwise derived observations; N = 27 observations, *random* and *both* only (see Appendix C); see rubric above for the scale.

Likewise, the Baron observation questions were not specific enough to produce very objective data. If these were the only criteria, the findings from the Baron questions indicate that teachers use critical-thinking instruction quite appropriately. However, some questions yield rather global responses. As an example, Item #1 of Table 5, was a measure of whether the teacher assessed the class as a whole as well as individuals in their critical thinking. This researcher

found that nearly every teacher gave the whole class as well as individual students some feedback, however minimally, as to how they were doing in their thinking. Similarly, for the other items in Table 5, most of the teachers in the study demonstrated each of these activities at some level.

Table 5

Teacher Daily Classroom Activity

Description of activity	Teacher conformity
Whole class as well as individual critical thinking assessment? (bar1)	Yes 22; No 5
Continual class period evaluation of student thinking? (bar2)	Yes 25; No 2
Teacher looks for sustained efforts at critical thinking? (bar3)	Yes 18; No 9
Transfer to other situations on the part of students? (bar4)	Yes 16; No 11
Teacher looks for side effects of her students' thinking? (bar5)	Yes 14; No 13

Note. Baron derived observations; N =27

Observed Student Classroom Activity

Tables 6 and 7 report observed student classroom activity. Two sets of questions are presented from the observation protocol (Appendix B). The first set of questions, Table 6, from Baron (1987), results in broad findings with regard to student activity in the classroom.

Two of the Baron (1987) questions in particular yielded a lack of student activity regarding critical thinking. The first has to do with metacognition (see

53

Table 6, Item 1 - Bar6). Metacognition refers to "the self-monitoring processes" throughout problem solving (Baron, 1987, p. 89). With regard to metacognition, there were no instances observed in which students were encouraged to think about their thinking and revise their work on the basis of their new insights. No teachers were observed saying to students, "Are you thinking straight about this problem?" None of the students was observed saying, "I don't think I have the right frame of mind to make a conclusion."

In only 3 of the 27 randomly sampled observations was there any evidence of metacognition on the part of students. In one instance a teacher asked her students, "How many made a mistake and know what they did wrong?" In another instance, a teacher asked his class, "What's an opinion?" Students offered various viewpoints. The teacher asked, "What if someone says the sky is blue, is that an opinion?" Various viewpoints ensued about colors students had seen in the sky. Some were insistent that the only answer was blue. The teacher described how an eye doctor had taught him to see green in the sky. A student replied, "How did you expect us to answer truthfully without giving us that information?" The teacher replied, "You have to dig a little bit deeper." A third teacher encouraged her students to "think about it," in a discussion of Othello. She asked one student, "Where's the digging, the depth below the surface?"

The second Baron (1987) question which yielded a lack of student activity regarding critical thinking had to do with whether students viewed themselves as scholars. . In only 11 of the 27 randomly selected observations of classrooms did

students see themselves as scholars (see Table 6, Item 5 - Bar84). Most of the time students were not initiators but reactors. The teachers would ask for a response from the students which the teachers had already planted in previous instruction and expect students to repeat the answer. This type of recitation instruction many times resulted in teachers asking questions, teachers chiding the students for not knowing the answer, and teachers answering their own questions themselves.

On rare occasions an instructional sequence, which encourages students to see themselves as scholars, might proceed as follows. Teachers would ask an open-ended question the answer to which could be given from several different viewpoints. Teachers would wait for students to either clarify the question, or give an answer and then justify their response. Finally, the teacher would ask the other students if they understood the question or if they agreed with the answer given.

Table 6

Student Daily Classroom Activity

Description of activity	Student behavior
Metacognition on the part of students? (bar6)	Yes 3; No 24
Students asking their own questions? (bar81)	Yes 24; No 3
Are the students challenging one another? (bar82)	Yes 18; No 9
Students piggybacking on one another's comments? (bar83)	Yes 17; No 10
Are the students viewing themselves as scholars? (bar84)	Yes 11; No 16
Are the students asking for justification and clarification? (bar85)	Yes 18; No 9

Note. Baron derived observations; N = 27

The second set of student daily classroom activity data is given in Table 7. The questions for this portion of the observation protocol (see Appendix B) were proposed by Richard Paul (personal communication, July 6, 1998). Paul's questions, an extension of his earlier work (Paul et al.,1997), modify his interview coding data analysis questions for use as observation questions. Further, in an attempt to operationalize these questions, this researcher framed the responses on a 6-point Likert scale as opposed to yes - no responses.

The specific nature of Paul's et al. (1997) approach allows one to see precisely what it is about the critical thinking that is either exemplary or in need of improvement. As an example, and by way of contrast, the Baron (1987) question (Bar 81) asked simply, "Are students asking their own questions?" A yes or no response was required. The difficulty faced by this researcher was, when students are asking questions in a classroom discussion, they ask different kinds of questions. Some ask only for information. Some ask the teacher or other students to help them clarify the question being discussed by the class. An example of a student information question this researcher heard was, "How do you do number 3?" An example of a student asking to clarify the question at hand was, "Is there more than one way to determine the point-slope form of a line?" Both are questions as reflected in Table 6, Item 2, where in 24 of 27 observations students asked questions. However, when one applies Paul's question, Item 1 in Table 7, the mean level of question clarifying in classrooms observed was only 4.1, slightly above halfway on the 6-point response framework. As a rule of thumb, this

researcher would have had to hear a clarifying question more than once and from more than one student in a classroom to rank this activity at a 4 or higher. Paul's question provided more detailed findings than those of Baron.

Table 7

Student Daily Classroom Activity (Paul Derived Observations

Description of activity	Degree of activity (mean)
Are students encouraged to clarify the question? (paul1)	4.1
Are students encouraged to gather relevant data? (paul2)	4.5
Are students encouraged to reason to a valid solution? (paul3)	4.2
Are there discussions of the assumptions? (paul4)	2.1
Are the implications of conclusions discussed? (paul5)	3.5
Students entered accurately into alternative viewpoints? (paul6)	3.5
What they don't know as well as what they do know? (paul7)	2.8
Intellectually challenging work that requires perseverance? (paul8)	4.1
High degree of precision and accuracy in reasoning? (paul9)	4.4
Do students honestly acknowledge their inconsistencies? (paul10)	3.1
Student fair-mindedness? (paul11)	3.4
Is there an atmosphere of thinking within a discipline? (paul12)	4.3
References to intellectual standards for critical thinking? (paul13)	4.3

Note. N = 27; Likert scale: 1 = *not mentioned* to 6 = *elaborated*.

Two of the Paul (personal communication, July 6, 1998) observation questions for student daily classroom activity yielded low findings. Item 4 (paul4),

Table 7 asks whether or not there are discussions of assumptions. Surprisingly, there were very few references to assumptions at all in any of the classrooms observed. Sometimes the idea of student assumptions was present but not mentioned, such as in the classroom cited above where the teacher was engaging his students in a discussion of what color the sky is. There were good opportunities to introduce the idea of assumptions. When the science teacher was giving a lesson on the reason for February 29, he could have asked the students to report their assumptions on whether every year is the same length, but nothing about assumptions was discussed. Instead the teacher assumed the role of expert on whether student responses were right or wrong. The teacher who was telling his students what the meaning of each proposition meant on election day could have solicited student assumptions about why there was an initiative on Indian gaming regulation, or on why an initiative may have been necessary regarding certain types of animal traps. However, there was nothing in his lecture about assumptions.

Item 7 (paul7), Table 7, required the researcher to listen for students expressing what they did not know as well as what they did know. Perhaps it is the nature of high school students, but no direct references to intellectual humility were heard in any of the classroom observations. Not one time was a student heard to say anything like, "I don't know very much about this subject. Could you tell me more?" Further, not many of the teachers modeled this characteristic. In most of the classrooms, the prevailing attitude on the part of the teacher was one of dispenser of information. The attitude of the students was one of reflecting back to the teacher what the teacher had taught them. If a fact was not going to be required

58

on the test, it was not important. On rare occasions did a classroom exhibit the atmosphere of everybody learning and researching together.

There is value in the Pathwise and Baron instruments, but they were generally found to be weaker than those suggested by Paul (personal communication, July 6, 1998).

Teacher-Reported Assessment of Their Critical Thinking Preparation and Practice

Table 8 reports the findings of teacher-reported assessment of their critical thinking preparation and practice. Both of the questions are from interview data. The first question asked teachers to rank their teacher education program for preparing them to foster critical thinking in their students. The response choice was a 6-point Likert scale. The mean, 2.8, well under the halfway mark on the scale, reflected that many more indicated an answer closer to no preparation than those who indicated great preparation.

Table 8

Teacher Reported Assessment of Their Critical Thinking Preparation and Practice

Category	Extent of conceptualization
How to assess whether a teacher is fostering critical thinking or not (i5)	Little or none 6; Limited 12; Elaborated 13
How teacher education program developed critical thinking (i9)	Likert scale: no prep.=1; 6=great prep. Mean 2.8

Note. N = 31

The second question asked the teachers to tell how they would go about

assessing whether some colleague was or was not fostering critical thinking through his or her instruction. Surprisingly, some teachers refused to answer this question or simply said they did not know. However, nearly half of them gave an elaborated answer to the question.

Summary of Teacher Interviews

Table 9 summarizes the results of the open-ended coding questions (Appendix A) which were recorded after each interview. Three of these questions yielded especially low ratings. Item 2, the mention of important intellectual traits of mind (c_2), yielded a mean of only 2.5. Twelve of the 31 randomly selected teachers did not mention traits such as intellectual humility, perseverance, responsibility, integrity, and fair-mindedness at any point during the interview. In some cases the prompt regarding open-mindedness was used during interview question one, (to me, critical thinking is_____). In those cases, the teachers agreed that open-mindedness was important but did not articulate any clear, elaborated, or substantive conception of its use. One teacher, however, for whom a level 5 was assigned on this question, made student responsibility a main theme of his instruction. He enumerated the goals for his science class:

To develop the students' ability in

- Scientific literacy
- Critical thinking
- Problem solving

- Self-responsibility

- Social responsibility

- Joy in inquiry and discovery.

Table 9

Summary of Teacher Interviews

Category	Extent of elaboration (mean) Likert scale: not mentioned = 1; = elaborated
Mention of basic skills of thought (c1)	3.6
Mention of important intellectual traits of mind (c2)	2.5
Mention of reasoning within the subject (c3)	3.3
Emphasis on problem solving (c4)	3.8
Mention of special need for critical thinking today (c5)	2.9
Emphasis on peer and student self-assessment (c6)	1.9

Note. N = 31; Likert scale: 1 = not mentioned to 6 = elaborated.

Item 5, Table 9, the special need for critical thinking today (c5), yielded a mean of only 2.9. Eight of the 31 teachers did not mention this need during the interview. One teacher gave an elaborated conception of students needing more than just facts about math. In part, she said, "Life is not about things we've seen before. . . . [Students] don't need to be spoon fed, and that's not just in math." Another teacher when asked to describe the critical thinking skills that he thought were most important for his students to develop, said "everyday life issues— balancing checkbooks, moving into a new home, setting priorities, the health of a

child." This researcher was surprised that in light of the rapid change in areas of multiple lifetime careers, the information age, and awareness of a diversity of social relationships, that some of the teachers did not touch on these areas during the interviews.

Item 6, Table 9, an emphasis on peer and student self-assessment (c6), yielded a mean of only 1.9. Twenty-two (71%), of the 31 teachers did not mention this need during the interview. One teacher who was rated very high on this question reported that she used peer and student evaluation rubrics to determine whether students were doing critical thinking. She allows her honors students to be teacher for the day where they evaluate their own performance. On a daily basis this same teacher said, "Writing is the main focus in English, and it does foster critical thinking, especially analysis of literature, self-evaluation—they actually have to evaluate their own writings." In observing that teacher's classroom, she had the class divided into six groups of four. Each group had to prepare a collective response to a question they drew. Each group had a facilitator, an evaluation recorder, a question spokesperson, and a taskmaster. After a few minutes to prepare the answer to the question, each group's spokesperson presented his group's answer. The other groups evaluated each group's presentation. The teacher of these students was one of only 4 of the 31 randomly selected teachers ranked as high as 5 or 6 on this question.

Even though all of the data in this chapter deals with the randomly selected teachers only, one comment is given here regarding the differences between findings for the random sample and the purposive sample. In coding the interview

questions to determine whether the interviewees did–did not mention basic skills of thought (c1), there was a statistically significant difference between those who were randomly selected and those who were purposively selected. The purposive group (mean 4.9) elaborated basic skills of thought better than the randomly selected group (mean 3.4).

Summary of Overall Effectiveness of Observed Critical-Thinking Instruction

Table 10 reports the findings of the Costa (1985) generated questions. Concerning Item 1 (Cost1): in only one classroom was a teacher found not to have his instructional events ordered. That teacher's observation is described under Profile W of the Weak Profiles section which follows. This researcher assumed for purposes of this project that Costa meant sequence of instructional events as opposed to order of importance. Nearly every teacher had some sequence of presentation. This researcher did not gather data on whether the material was presented in order of importance. That judgment would have required analysis of curriculum which was beyond the scope of this study.

Concerning Item 2 (Cost2): Are multiple objectives handled at the same time? Twenty-three of the 27 randomly sampled teachers, which were observed, demonstrated lesson presentations with more than one objective. As an example, several teachers began the class with a writing activity in which students would journal or answer some focus questions. Typically the teacher would then review the quick write and any homework that had been assigned. Nearly every class had

some direct instruction time in which the teacher explained new material. There would follow some format for directed practice or cooperative learning. Finally, there would be some closure activity in which old material was reviewed or students would again journal about what they had learned. Lesson objectives were posted in few classrooms except as activities for the class period. Often the multiple objectives were disjointed.

Concerning Item 3 (Cost3): Does it all come together effectively? Twenty of the teachers in the random sample demonstrated effective lesson presentations. This researcher did not try to set a minimum percentage of time during the class period when critical-thinking instruction was evident. If some attempt at student-centered, question-based problem solving took place at any point during the class period so that students were engaged in the learning process, the teacher was rated a yes. As might be expected, this researcher observed some classrooms where the teacher did all of the talking, where students were bored, or where the atmosphere was so chaotic that in the observer's opinion effective learning was not taking place. In those situations, the teacher was rated a no on this question.

Concerning Item 4 (Cost4): Is time allocated effectively to produce critical thinking? Nine teachers, or one-third of the randomly sampled observations received a no on this question. The reason for this response was usually due to ineffective use of class time. The class did not begin when the bell rang. Multiple interruptions distracted from student learning. Time was wasted on inconsequential matters such as ill-prepared handouts that required much explanation. Class house keeping items, such as seating charts or how to arrange cooperative learning groups

consumed inordinate amounts of time.

Table 10

Summary of Overall Effectiveness of Observed Critical-Thinking Instruction

Description of activity	Conformity
Are the instructional events ordered? (cost1)	Yes 26; No 1
Are multiple objectives handled at the same time? (cost2)	Yes 23; No 4
Does it all come together effectively? (cost3)	Yes 20; No 7
Is time allocated effectively to produce critical thinking? (cost4)	Yes 18; No 9

Note. Costa derived observations; N = 27

Strong Profiles in Teacher Interview Responses and Observational

Data

The following profiles are of the four teachers who in the opinion of this researcher best articulated and demonstrated exemplary practice in high school critical-thinking instruction. Three of these teachers were from the random sample. Only Teacher C was from the purposive sample, those recommended by their principals. It was a pleasure to watch these master teachers bring out the best in their students.

Profile A (318)

Teacher A indicated that she saw critical thinking as independent thinking—that a student was not following the crowd, that he was thinking for himself and

65

that the thinking had to be done with some degree of depth. In her instruction she indicated she always asked why; that she never accepted an answer on face value. Teacher A said she asks her students for the process of their thinking. She indicated she often asks a student, "How do you know?" and "Prove it to me."

On a daily basis in her classroom she uses dialectical journals in which she requires students to quote from the selection and then respond to the quote. She asks students to make their responses analytical. She also requires some reflective pieces in order to search for relevance and meaning in their own lives.

Teacher A does not have a problem reconciling the covering of content and fostering critical thinking in her classroom. She believes that critical thinking is embedded in her teaching in every area. She believes that the most important critical thinking skills for her students to develop are those of Bloom's Taxonomy, especially (in her words, not Bloom's) the analytical, inferential, and interpretive skills, evaluation, and synthesis. Teacher A feels that outlining works for critical thinking, being able to put things in relationships and in groups are important critical thinking skills for her students to develop. She is particularly impressed with students who can draw parallels and connections with other pieces of literature. She uses the ability to draw connections as a criterion for determining whether students are thinking critically or uncritically.

When asked what her personal conception of intellectual criteria or standards is, Teacher A replied that she looked for students who were analyzing and interpreting from a logical base. Where the student draws an interpretation or an application to something outside the text, that shows her the student has some

intellectual capacity. She indicated that if she were giving a student advice as to when to accept or reject a piece of writing, she would advise the student to examine what he knew to be true, what possible motives the writer might have, and whether or not there might be faulty reasoning in the work.

Teacher A engaged her senior advanced-placement English class students in a whole-class discussion of *Othello*. The discussion was based on student reports. The students at their seats were to peer assess the work of the presenters with the following criteria:

Thesis strongly stated.

Supporting details—relevance and quotes

Well-organized

Good diction

Interestingly written (sentence variety; figurative language—similes, metaphor; no artificial conclusions)

No typical conclusions

Although it appeared to this researcher that the criteria needed some work to reflect some elements of reasoning or standards of accuracy, depth, clarity, and so forth and intellectual traits such as fair-mindedness, the rubric was effective in producing interactive questions and challenges on the part of the students. At one point the teacher chided her students for using the standard comment, "Good diction. It flows," She went on to push them for clarity of the question.

One student criticized, "He needs quotes to support what he's talking

about." The teacher responded, "Listen to what Tom is saying. Something about 'sexually challenged' bothers you. What is his thesis? Look at the details. What do the details point to?"

At one point the teacher responded to a student's paper, "There's something about your paper that strikes me as cold. Where's the digging, the depth below the surface?"

One student said, "I liked the point he made about disparaging women. I liked the part about kissing his wife out of respect," to which the teacher replied, "Justifies his jealousy?" Student, "No."

Another student said, "I didn't like the use of irony in his thesis. It's not subtle irony. It's obvious." Teacher, "Listening does change our perspective."

Even though some of the comments sounded harsh to this observer, there was a spirit of congeniality and fairness in the class that prompted a sense of honesty. There was an element of humor. At one point the teacher said, "I don't know what it is about GATE and honor students. You're so boisterous! You think I like you? I'm a tough nut to crack." There was also an atmosphere of support and encouragement, but it wasn't phony. Teacher A said to her class, "None of us in here is stupid. What you've presented here is a fourth or fifth revision."

After class this observer asked Teacher A, a veteran of 22 years, where she got her education in critical thinking. It was pointed out to her that she had rated her teacher preparation program for critical thinking a one—no preparation. "I got it because I'm a critical, independent thinker. I got it from the home. We had these kinds of discussions at home. We discussed what we read. My mother and the

whole family had college degrees. I like to ask why. There's too much emphasis on process in California. It's the product!"

<u>Profile B (202)</u>

Teacher B, following a career of 35 years as a chemical engineer, has been teaching for seven years. He rates his California teacher preparation program a three, less than halfway between no preparation and great preparation, in terms of how it prepared him to foster critical thinking in students. He did credit two reading professors with doing a good job in the area of critical thinking.

When asked about his concept of critical thinking, he spoke of being able to analyze something that is written or spoken to determine the message and to ascertain if anything is left unsaid. Critical thinking to Teacher B is to see into the problem, to see what's past the surface and ultimately to synthesize concepts and actions. When asked what intellectual processes he would use to determine whether analysis was being done critically, he said he would assess how students answer open-ended questions. Some students can synthesize complete answers and understand the concepts as well as the mechanical formulation of the answer. "Some students just spit back stuff, and others can really generate." To Teacher B, a student using good critical thinking can really explain a philosophy, point, theory, or understanding. He doesn't use jargon, but uses his own words.

Teacher B says that he uses very little direct lecturing. He gets discussions going and gets students to generate their own questions. There are no dumb

questions, and he says he never rejects an answer. He just asks for additions to it.

He wants his students to think, and he wants to bring the outside world into the

classroom. On a daily basis Teacher B uses the SQ3R method: survey, question,

reread, review, retell.

When asked how he reconciles covering content with emphasizing critical

thinking, Teacher B said,

> I never get through with the textbook. My goals are to prepare the
> student for life. Chemistry is the medium. That's my philosophy. .
> . . Chemistry is the transition between high school and college. . . .
> Everyday's work is a thinking process, and I sacrifice quantity for
> quality.

Teacher B believes that problem solving is one of the most important skills

for his students to develop. Students need to be able to analyze problems to

determine what is really unknown, how to make a good judgment of the answer,

and then figure out the best method.

If he were given the task of determining whether another teacher was or was

not fostering critical thinking in his or her instruction, Teacher B said that he would

analyze the students to determine whether critical thinking was embedded in the

learning. He would check to see whether the students were reading, analyzing, and

expressing themselves. He would look for student-centered teaching.

In terms of intellectual standards, Teacher B wants his students to

understand patterns. He wants them to "see something and think for themselves

what's happening, not answer a question that some guy thought up for them. . . . I

want them to develop their own questions." He wants his students to look for

concepts, relationships, conclusions, extrapolation and prediction of what they

think will happen. What he wants more than anything else is for his students to experience the "joy of discovery and inquiry."

Teacher B engaged his general achievement level students in a chemistry lab wherein various chemicals were mixed from pipets that were prepared before class. Students worked in groups of three or four. Teacher's questions and instructions during the lab period reflected the philosophy he professed during the interview.

> You have to design some experiments. What do I mean?
> How are you going to do [the experiment]? How did you do it *exactly*?
> Tell me exactly. That doesn't mean anything. Tell me exactly what you're going to do. How would you check to see if sodium hydro-carbonate is in something?
> How would you check for iodide? Who did the homework? Come on, take a guess. What's your best guess? What if your life depended on it? What if they would hang you by the thumbs if you didn't guess? You've got to start thinking. If you don't spend a half an hour a night on chemistry, you're not going to learn it. I'm going to let you decide—bleach or not? A couple of grains—no more!

Throughout the class period, Teacher B responded to student questions with questions. After class he told this observer he had been treated that way by his first employer at Dupont many years ago, and that's the way he learned.

During the class period, one of the students introduced himself. "I'm Angelo. I'm smarter than the others, but they don't like me." Several students were interacting with each other, many with questions. "That's kind of milkey, huh?" "No, that's more blue because you put more of the white stuff." Students were asking questions of the teacher about current events science article assignments they were to read, highlight, list five facts from the article, and answer

71

an open-ended question in a short essay. Examples of the open-ended questions were, "What would happen if . . . " "The problem with this article was . . . "

Toward the end of the class period, one student asked a question about whether or not to use distilled water. The teacher exclaimed, "Good question!" The student grinned and poured from the distilled water bottle.

Teacher B turned to this observer and seeing the cassette deck on his desk indicated he usually played some kind of music, classical or whatever helped during the lab period. That day they had done very well without it.

Profile C (502)

Teacher C, a 36-year veteran English teacher, took a class at the University of Southern California in the last five years in critical theory and participated in the Literature Project at California State University, Dominguez Hills, within the last five years. She has been a mentor teacher and has done considerable research on student writing composition.

Teacher C's concept of critical thinking is "the ability to analyze, to synthesize information, to summarize; to look at information as to who is the speaker, what is the intent; to read for inference; to understand bias; to come up with your own interpretation of ideas and to apply them to new subject areas and new situations."

On a daily basis, she gives her students journals that relate to the essay topic that they're going to be writing based on the literature that they're reading. She

gives her students a key question to think about. She asks her students to go

beyond what is the obvious explanation. As an example, when her students studied

The Scarlet Letter, she applied Hester's story to the President Clinton situation.

Her students considered why society looks at adultery differently in different time

frames and what that reveals about our cultures.

When asked what her view was on the pressure to cover content to the

exclusion of critical thinking, she said, "Critical thinking is what we're here for.

They can learn basics if you teach critical thinking." She is dismayed by teachers

and students who are not used to thinking. School is not fascinating to them. She

believes that students at every achievement level can think critically. "I think most

teachers begin at the wrong end of the spectrum [beginning with basic facts and

working up to critical thinking]. Most kids will buy into a class if you can show

them 'so what.'" To prove her point she took a regular freshman class last year to

show they could be taught to think critically.

> I took the class because I wanted to see could I [sic.] make a
> difference from the beginning, and you can. They were very
> average students, but they came with me because I was excited. I
> taught them a different way to look at something. I cared what they
> said. They knew I cared what they said. They knew I wanted to
> hear what their opinions were, and the other kids wanted to hear
> what their opinions were. So, it was a very exciting class for all of
> us.

When asked what critical thinking skills Teacher C thought were the most

important for her students to develop, she indicated reading carefully and looking

for the bias of the author. She wanted her students to look carefully for what is not

said as well as what is said, to understand why the person is writing and to whom

73

he or she is writing. She wanted her students to buy into the notion that language is power and that they can empower themselves.

If Teacher C had the task of determining whether a colleague was or was not fostering critical thinking through her instruction, Teacher C said that she would look at what her writing assignments were and how she asked questions. She would question the use of objective tests. She would look for whether the teacher in question had a clear idea of where she was going with an assignment. Did she know what she wanted the student to know at the end and how she would measure it? When the students didn't know, how would she reteach it at that point? Was the teacher constantly assessing whether the student was getting it? She would look to see whether the students were just regurgitating information, or whether they were actually able to do something with this knowledge. Could the students see an application as to why they studied this topic?

With regard to Teacher C's personal conception of intellectual standards, she agreed with the follow-up prompt that they needed to be accurate, but she was also interested in "how well they speculate, how well they follow through on their speculation, and what conclusions they come to based on their logic, based on their evidence. In English, we're not going to have hard, clear answers." Teacher C gives thesis-driven essays. The students have to come up with the thesis. Her standard is this question. Has the student proven his point? Teacher C believes one can adapt this method to any age level, but one has to teach the students how to come up with a conclusion.

Teacher C rates her teacher preparation program at a very low level—1 or 2

74

on a six-point scale. Her teacher preparation classes in the 1950s were not considered toward her degree. They were taken after school hours. She says any preparation in critical thinking was done by the professors of core subjects. Even when she came to California and got her California credential, she was never taught critical thinking, as such, in any of her classes. "Frankly, I learned to teach critical thinking from teaching. . . . The Literature Project gave validation to what I was doing, and it took a long time to learn to do it." Critical thinking was self-taught, and she believes that is a very important point. She believes it *has* to happen that way. The best teachers continually examine their teaching. "Most teachers don't do it, and why should they? You're not rewarded." She believes that administrators and parents need to value critical thinking. She believes students already do. At her high school there is a lot of support for critical thinking within her department. Teacher C helped craft that emphasis. She was department chair for ten years.

Teacher C's class, which this researcher observed, was an eleventh-grade AP–Honors American Literature class. There were 25 students in the class. The classroom was divided down the middle with half the class facing the other half. The teacher was on her feet the entire period walking up and down the area in the middle leading a whole-class discussion of *The Grapes of Wrath*.

Teacher questions were designed to draw out student comments and questions as well as application to their own lives.

> Why did you summarize and outline *The Grapes of Wrath?* What
> do you think the major idea in chapter 1 was? Why would you
> choose these characters? Why should I care about them? [A student

answered, 'To show that even these people have some worth.']
Ahh! You've read Steinbeck before. Okies were discriminated
against, objects of disgust. Has that changed for some children in
America today? Think for a moment. Who do we marginalize
among the faculty? [Students offered several guesses—old
teachers, custodians. Finally a student said, "Substitutes!"]

Think beyond science here! Open your minds [referring to
smooth-talking characters in the story and a student's comment that
reflected a simplistic assumption]. I knew you all knew that. I want
to show you how Steinbeck can capture a character. What's the
difference between tight-fisted and miserly?

Several student questions were discussed during the class period regarding

foreshadowing, universalizing, communism, religious references in the novel,

references to sexual intercourse in the novel. One student remarked that sex was a

coping mechanism—no television; they were too poor. An animated discussion

evolved around the idea of moving and what it would be like for us if there were

thirteen people and a big dog in one car. The teacher asked, what would you have

to eliminate? Students replied, "stuff."

The teacher's assignment for a research paper on *The Grapes of Wrath*

reflected some preparation for her students to think critically. They were assigned

to three groups. Each group was to develop a newspaper which might have been

printed in the 1930s. One of the following newspapers was assigned to each

group: *L.A. Times, N.Y. Times, The Daily Breeze* (a local weekly newspaper).

The students were told, "This is research. You have to have real stuff." The

students were expected to use the style of the newspaper they were assigned.

Students discussed the fact, for example, that the *N.Y. Times* had no sports

section and why. Their product had to include Letters to the Editor, Obituaries, and

everything their assigned newspaper carried. Teacher C's closing admonition to her class was, "Remember, when you don't know, it is okay to keep your mouth shut."

Profile D (214)

Teacher D entered education thirteen years ago following careers in social work and stained glass. She teaches ninth-grade mock-trial and eleventh-grade U. S. History. Her education in critical thinking within the last five years was as a California Regional Fellow for Restructuring of Schools.

To Teacher D, critical thinking is "analysis, weighing the parts of an idea, the veracity of an idea, comparing an idea to another idea to gain further insight." She saw critical thinking as making meaning of an idea and seeing why that idea is important to the student's here and now and how that adds to his overall understanding of life. When prompted with the question considering standards for whether a student is thinking critically or uncritically when he engages in these activities, Teacher D responded that she had to do that all of the time when she graded her students' papers. First, there must be some kind of hypothesis or position taken. Then, in a good paper, the position would be supported with some concrete details but also weighed against opposing details. "The difference is sifted out so that you have a residue of how that judgement came to be. In the better papers that is what I would see."

On a daily basis, Teacher D has a focus question which is broad enough so

that there is no single answer, but the students would have to weigh a variety of materials. The focus question on the board the day Teacher D was interviewed was, "Did the Declaration of Independence justify the Colonists' claim for independence?" Yesterday's question was, "Could any decisions have been made on either side to deescalate the conflict?" These questions spawned discussions and questions on the part of her students regarding the rights that the Colonists thought they had and what they felt was such an insult to those rights. Teacher D reported that she was trying to get away from the students just getting the answer from the book. She wanted them to move toward synthesis and rationalization. She daily expects her students to take a position and then use concrete details to argue the position. "Most of the students are very concrete. They have the what. It's trying to get a sense of the why." Teacher D believes that students already make judgments this way; however, transitioning that activity to school is her challenge. "They're so used to giving very specific—is this answer right or wrong—that they're not taking that leap." She sees critical thinking as essential to democracy and our world.

Teacher D was frustrated by student ability. She discovered a nonreader in her class the day she did this interview. Many are at a very elementary level in their reading ability. These are mixed with students who have a very good reading ability. "You have to use the skills the students bring to the classroom. I think it's impossible. I don't know how we do what we do."

"Being able to understand what a line of reasoning is," merited number one as a critical thinking skill that Teacher D wanted her students to develop. After a

chuckle at the obviousness of her answer, she said, "If you look at Rickie Lake

[popular television talk-show host] and what they [her students] listen to, there's no

rebuttal to the point. You just go to another point. You hop around, and now

debate has become something [of] who can yell the most." Teacher D emphasized

scientific method, having an hypothesis and being able to support it with detail,

willingness to look at opposing views and personal judgements [assumptions], to

be open to critical self-analysis, and the development of tolerance as other important

skills she wants her students to develop in critical thinking. She believes it is

important to appreciate how consideration of opposing views interacts to our better

good.

After being prompted about accuracy as an intellectual standard, Teacher D

responded to the question about her personal conception of intellectual standards.

"Accuracy is helpful, but again, it has to be logical, thorough, and clear."

Teacher D rated her teacher education program's ability to prepare her to

develop critical thinking in her students at a 1, no preparation. "I don't remember

it," she said, "Zero."

In a conversation with Teacher D in the hallway following the interview,

Teacher D said she understood why teachers had trouble getting students to write

and think. Some of them cannot read the words on the board or posters. Some

cannot make connections to basic concepts of social interaction. Instead, one might

say, as an example, being hit by someone is bad just because it hurts him, not

because it violates his personal rights.

79

Teacher D continued, "Many teachers give up and go to the movies [show videos], word puzzles and worksheets. I'm not for passing these kids on. What do we give them, a modified C that does not mean anything anywhere else? These kids are functioning at alpha level. They're zoned out. They are not trained to think when we get them."

Given the foregoing comments, this observer was eager to see what Teacher D's instructional strategies might include. The class observed, a first period, eleventh-grade U. S. History class of 36 students, began the moment the bell rang. "I need your work in order for you to get a grade," Teacher D began. "How do I know you know without looking at your work? Sooner or later you've got to get on it." The teacher then passed out the student portfolios of essays which she said would argue for student grades in this class. The students were then given the class period to work on their essays, "Do the grievances listed in the Declaration of Independence justify the Colonist's claim for independence?"

"This is what it should mean to you," said the teacher animatedly. "If our government did this to us today, we should overthrow the government." Throughout the class period as students worked alone and in groups of two or three, the teacher made similar passionate comments to her students who appeared to be engaged as though they were Colonists and the teacher were Patrick Henry.

"What's the purpose of a mother or father?" asked Teacher D as though the Colonists were children of England. "To protect their children? What if they don't? Then, they've abdicated their responsibility!"

"What's the purpose of government?" asked the teacher, and then

answering her own question, "To protect our rights." Perhaps this is one of the weak points of this teacher's otherwise strong profile. She does not give students adequate time to process her questions. She is driven to move on. In fact, in her interview she agreed that covering content was a major problem for her.

The teacher effectively held the attention and engagement of her students. After reading a student comment on her essay that the British were not congenial, she shouted to the whole class, "We're going beyond nice and genial here. We're talking treacherous, egregious!" The students chuckled. They were animated by their teacher's passion and vivacious presentation, yet they were not just being entertained. There was a sense of wheels turning in the minds of these very average high school juniors. One other observation—Teacher D never in their presence referred to her class as anything other than "students." They were not "kids." They were "students."

Isolated Exemplary Practices Either Articulated or Demonstrated

Some teachers showed strong profiles in the interview but weak profiles in the observation. Others showed weak profiles in the interview but strong in the observation. The purpose of this section is to report on isolated exemplary practices in critical-thinking instruction either from the observations or the interviews. All nine teachers discussed in this section were from the randomly selected sample.

<u>Teacher E (401)</u>

Teacher E used various methods to keep her junior and senior American Government class engaged and participating. She began the class with a role-play. Five students were handed signs. On each sign was a political ideology: conservative, reactionary, liberal, moderate, or radical. The students were to come to the front of the class and arrange themselves first by age, then by shoe size, then height, then political ideology. In each case they had to decide whether the arrangement was readily apparent and observable. The teacher asked several questions regarding the ideologies.

> Do radicals and reactionaries have anything in common? Adolph Hitler I would call a reactionary. What do we know about what he did? What kind of world was he trying to set up? Kaytu, hold yours up [liberal]. Does she want change? Martin, you're a moderate, what does that mean? How would you identify President Clinton, Newt Gingrich, Colin Powell? In American politics, do we have any radicals or reactionaries? Have we ever? Have any been elected officials? Why not? Who wins our elections? Do they have that in other countries? [Liberals in] election advertising do not tout being liberal, but [conservatives in election advertising] may say they're conservative. If I vote, does that make me an activist? No? What else?

During the class another social studies teacher from across the hall stuck his head in the door and got into a discussion with Teacher E regarding liberal vs. conservative. The students were disagreeing and posing their own questions among each other and with the teachers. Since the next day was election day, students were assigned to bring in as many brochures as they could find to analyze. A handout was used to stimulate thinking about the differences between political ideologies. Students were to choose from pure liberals, pure conservatives, libertarians, and populists to label such statements as, "liberal on economic matters

82

and conservative on social ones, conservative on economic and conduct issues, or want a small weak government." A lively discussion ensued over the correct responses. The teacher allowed the students to come to their own conclusions without telling them the right answer. They were encouraged to justify their positions and to enter accurately into alternative viewpoints. There was a distinct atmosphere of thinking within the political science discipline. Students were asked to clarify and bring focus to their questions.

Teacher F (410)

Several examples of encouraging students to persevere were observed. In an integrated science classroom of 31 juniors, Teacher F had placed some posters on the wall: You can't aim too high; You never know what you can do until you try; Knowledge is power. With regard to a lab report, Teacher F began the class with journal writing in which the students were required to write answers to these questions: What do you think you will need to do to get an outstanding on your lab report? Is there anything you will have to do different from normal? The lab report was to be about an M&M candy experiment they had done. Teacher F encouraged perseverance and accuracy. "Just saying the color changed—that's not enough. You have to . . . "

Teacher F encouraged her students to think as scientists. "When scientists publish reports, they . . . " Further, student work on scientific method was posted on one whole wall of the room.

Teacher G (209)

Teacher G articulated a limited conception of critical thinking, what he did on a typical day in class that fostered critical thinking, what critical thinking skills he wanted his students to master, or what his personal conception of intellectual standards was. He articulated little or no conception of the difference between assumption and inference and between inference and implication. However, when he was observed in his classroom before 38 pre-calculus, trigonometry juniors and seniors, he demonstrated a very strong concept of many critical thinking components. His students were engaged in problem solving, arguing with one another and with the teacher over alternative solutions, and the work was intellectually challenging. There was a definite atmosphere of thinking within the mathematical discipline, and there were many references to intellectual standards for critical thinking throughout the class: relevancy, accuracy, precision, depth, sufficiency, logic, clarity, and consistency.

Several of the teachers this researcher interviewed and then observed, like Teacher G, appeared not to have a vocabulary to discuss critical thinking, but demonstrated at least a fundamental understanding when they taught. Not all of the skills and standards were expressed in terms such as accuracy and precision, but the teacher would say, "Can you give me a better answer?" In that way, the students were encouraged to accuracy and precision even though the words were not explicitly stated. This finding will be discussed further in chapter 5.

Teacher H (405)

With Teacher H (405) there was no time wasted on roll-taking. The bell rang, and the class began. Teacher H worked on his feet in whole class discussion all period pacing the aisle between half the desks facing the other half. This same configuration occurred often where lively engagement occurred in the classrooms this researcher observed.

Participants in Teacher H's class were immediately thrust into Colonial America and a debate over the Proclamation of 1763. "By decree of the king, you are not allowed to move past the Appalachian Mountains," said Teacher H having a student point to the place on the wall map. "Do you understand that? You and your sister, Christina. What's the purpose of your coming to the new world?" Teacher H helps the students decry the fact that they've just defeated the French for all the new territory, and now the king says they can't go there. "What are you going to do?" Students reply, "Go anyway!" The teacher dons various imaginary costumes to become first John Hancock, the smuggler, and then a British officer with the same last name as his demanding to live in their houses that night.

Question and answer technique predominated, but Teacher H pushed his students, and they interacted with each other and the teacher. This observer would have felt very uncomfortable as a student in this class if he had not read his assignment. One by one the list of historical events was ticked off of the chalk board: 1763 Proclamation, 1764 Sugar Act, 1765 Stamp Act, 1770 Boston, 1773 Tea, 1774 Intolerable First Constitutional Congress, 1775 Lexington. Teacher and student acted out each particular—questioning, dissecting, and analyzing. Students

were treated as scholars figuring out what happened and why. Together they become a band of historians engaged in all-consuming research.

Teacher: "Everybody say it: 'No taxation without representation!'"
Students shouted it out.

One student exclaimed, "Now I get it!"

Teacher: "I'm just trying to get you to think about that, Joe. What do you think when I use the word 'massacre'? 20's, 50's, hundreds? Plus emotion. Plus hostility."

Joe: "It depends on how they died."

Teacher: "I guess in English class you've talked about the emotive qualities of English publications. Five people was a massacre at the Boston Massacre."

These junior advanced placement U. S. History class members were well served by their teacher on this day. Yet, Teacher H was one who articulated a limited conception of what he does on a typical day in class that fosters critical thinking, of what critical thinking skills he wanted his students to have, or of his own personal conception of intellectual standards.

Teacher I (215)

Teacher I provided another example of good practice in whole class instruction. Her 39-student class of junior and senior intermediate algebra students was also arranged with half the desks facing the other, aisle down the middle. Teacher spent the majority of the period in whole-class instruction, however, she began with a "Five-minute Check" which consisted of three questions about the

86

slope-intercept form of a straight-line graph. The teacher allowed this observer to introduce himself as someone who was working on a doctoral degree and who was in the class to observe a good teacher at work. Teacher I was exceptionally good at drawing her students out, at asking the appropriate questions at the appropriate moment:

> What does that mean? What does *intersect* mean? What does *y-intercept* mean? What's the slope? I think you did it wrong, then, Michael. Does the slope change if you reverse the points? What don't you know? You're wrong. Tell me what you did. What's special about any point on the y-axis? What does *implied* mean, Jason? What if there's a number in front of the y?

In response to the last question, Jason gave the right answer. Turning to this observer, he proudly asked, "Always thinking! Hear that, Mr. Ph.D.?"

Teacher questions continued. "How do you know it's a line? How many points are on this line?"

Students were eagerly taking notes from the overhead projector screen. Their questions reflected involvement in the thinking process. They were not just trying to recall the answer the teacher wanted: "That's all I have to do? Does that work all the time? Oh! I put the x on top! I'm confused because . . . " This class was a good example of a very average group of students, none of which had to take this course. They had already taken Algebra I and Geometry. Not only did they voluntarily sign up for this course, they were eagerly trying to figure out the material. The teacher praised the text selection which is geared toward critical thinking.

Teacher L (510)

Teacher L provided an excellent answer to the interview question in which she was to describe what she does in a typical day that fosters critical thinking. This 17-year veteran, junior English teacher said that she leads students to critical points of literature and gives them an opportunity to think beyond the text. Research is assigned for every unit with writing and class discussion. The students are expected to respond in class and create a product. The students prepare their own guidelines. They become leaders of seminars. They prepare writing portfolios. Students compare and self-assess their portfolio work from the sophomore year with what they are doing in the junior year. This assessment reviews choice and development of topics. When Teacher L was observed, she had 20 students analyzing *The Crucible* in a whole class discussion. Students were encouraged to clarify the question, gather relevant data, and reason to a valid solution regarding the characters in the piece. They were asked to project what would happen next. The weakness with her presentation was that although it was not totally teacher dominated, it was teacher controlled, and only a few students were participating in the discussion. Students did not acknowledge their inconsistencies and were not asked to analyze their own assumptions, prejudices, or biases. They did not enter into alternative viewpoints. However, one of the strong points of Teacher L's class was the constant grounding of the play to events in history, such as McCarthy and prejudice, witch hunts of the 1600s, and President Clinton's interrogation regarding sexual misconduct. In general, this

88

investigator was prepared for more than what he saw based on Teacher L's answer to the typical day question in the interview.

Teacher M (116)

An example of a teacher treating his students like scholars was Teacher M. He had his 18 junior advanced placement English class engaged all period long in a seminar on *The Scarlet Letter*. They sat in a circle, and each had come prepared to add to the discussion with answers to research questions they had prepared in advance from critical essays in journals students had located themselves in the school library. This teacher was very invested in his students and they obviously in him. He was preparing to take them on a clipper ship within three weeks and had just that day received the approval of the district. Students discussed the Picasso exhibit at the Los Angeles County Museum of Art. One of them had been to the Three Penny Opera playing at UCLA. During the class a package arrived for the teacher. He opened it, and it was a sweatshirt from one of his former students at MIT with a letter that he read to the whole class. In the note the student wrote, "I realized how screwed up [name] High School was, but I had the best teacher there." Teacher M requested that other students send him sweatshirts from the universities they would attend.

After class, Teacher M spoke to this researcher in the hallway. We had previously discussed where he had picked up this critical-thinking instructional method. He said he developed it from other faculty at this high school and had improved on it over his 12 years there. He said he had added six hundred

89

anthologies to the library in working with the librarian over the years. Then, Teacher M said there was great irony in this. He'd been called into the principal's office that very morning regarding signing in late in the mornings. The principal asked him how long he had been there. He answered. Then Teacher M was told that it was time for the administration to find him another school site. Teacher M confided, "This isn't about creativity and doing things for kids. It's about containment and signing in on time. Everybody is demoralized here." It should be noted that this inner-city high school is 1 of 100 that the state has threatened to take over if their student performance does not improve. The assistant principal was at a loss as to why so few teachers from that school chose to participate in this study. This researcher saw Teacher M as a light barely staying lit in the storm.

Teacher Z (205)

Even though Teacher Z had an overall weak profile in both interview and observation (see section to follow), when asked his view of the position that some teachers feel they have too much other instructional work to do in order to have much time left for fostering critical thinking, replied, "Oh, no! I think critical thinking is why we're there to teach." Perhaps this second-year teacher will grow in his ability to articulate and demonstrate a clear position of critical thinking in the future. It appeared to this observer that he had attached himself too much to multiple intelligences and collaborative learning without a workable understanding of how to use critical thinking as an effective primary instructional tool.

<u>Teacher Y (206)</u>

Teacher Y also had an overall weak profile in interview and observation (see section to follow), however, he said that he did not agree that he had too much content to cover in order to foster critical thinking. "Yes," he said, "There's material to cover, but everything moves toward critical thinking." Unfortunately, the day he was observed, the majority of the English class period was spent on designing quilt squares. Teacher Y's emphasis on problem solving in his interview, when asked about important skills he wanted his students to develop, was promising, but the observation did not indicate challenging work for the students to do.

Weak Profiles in Teacher Interview Responses and Observational Data

All four of the teachers profiled in this section were from the randomly selected sample. They all articulated a weak profile in the interview, and they demonstrated a weak profile in the observation.

<u>Profile W (612)</u>

Nineteen of the forty teachers in this study entered education from another field. Teacher W entered education nine years ago, having been a loan packager. He teaches freshman and sophomore English, but he is best prepared in the area of philosophy. Teacher W has not attended any conferences in critical thinking in the

last five years, but he cites Korsitsky, *Science and Sanity* and S. I. Hayakawa,

Language in Thought and Action as books he has read that have helped him with

critical thinking.

Teacher W explained his concept of critical thinking. "From the standpoint

of terminology, a figment of uncertainty. . . . People who are extremely critical

thinkers don't think that thinking is a scientific term. . . . I was moderately well

educated a number of years ago, and I was forced to take Education classes, but if

Education is ever going to earn some respect, I think it had better clean up its

terminology. . . . But, I'm digressing. Critical thinking, I don't know what the hell

it is."

When asked what he does on a daily basis to foster critical thinking,

Teacher W replied,

> Exemplary, I'm not. The kids are reading at the fifth grade level in
> 14-year-old bodies. . . . The ninth graders avoid it. The tenth
> graders are like philosopher kings. . . . The eleventh and twelfth
> graders begin to get it. . . . I start off with classifying—functional
> grammar. . . . I tie it to the notion of inference, judgment,
> hypothesis. . . . In a way they get it. They give me the right
> answers, but they don't apply it to their own lives. . . . I tell them,
> "You obviously don't believe your science classes."

When asked about his view of having too much other instructional work to

do to have time for fostering critical thinking, Teacher W replied, "Teachers are

whiners. They never work anymore. They do a lot of cry-baby stuff. If you're

hired to do this job, you just do it." When prompted about "instruction work"

meaning "covering content," Teacher W said,

> English is more nebulous than that. I'm going to cover the things
> they require, but frankly, it's boiled down to I'm going to do

92

Romeo and Juliet with the ninth graders. I'm going to do *Julius Caesar* with the others, but otherwise, I'm more or less left to my own devises. I'm not lying when I say that they read at a fifth-grade level, and it's against the rules to remediate. Is what I'm doing making any sense? Would their time be better spent learning how to read? Those are interesting questions that no one has the integrity to answer.

The rest of the interview was clouded with Teacher W's unwillingness to use the term "critical thinking." He said, "I don't get much sense out of that phrase." When asked how he would evaluate a colleague's use of critical thinking, he said, "That doesn't do much for me. . . . I'm cynical." When asked concerning his personal conception of intellectual standards, he replied, "Like science, it's an accident. False inferences are easier to make than true ones." Teacher W rated his teacher preparation program's preparation for critical thinking between a 3 and a 4 on a 6-point scale. He said they were on "the self-empowerment" bandwagon.

Generally, this researcher found Teacher W to be as cynical as he described himself. He saw a lot of bad practice going on around him and in his own teaching, but he did not know what to do about it.

Teacher W's class of twelve ninth-grade students began with Teacher W sarcastically using comments like, "Hello!— Joseph?" and "I can start—Christina's done I can tell," to motivate his students to rewrite a sentence on the chalk board. The sentence was "[proper name] High School would work better if you will make the school bigger because some classes have to [sic.] many students in one class and sometimes students can't learn because theres [sic.] just one teacher to help."

To one student Teacher W said, "Earnestina, you don't look happy. Do

you know what we're talking about? I'd start by reading aloud to myself."

Teacher W asked the class what an inference was. (This observer strongly suspected that Teacher W put that question in because he had been asked that same question in the interview.) One student answered that it was an opinion. Teacher W said he knew what an inference was. As an example, he said, "I think Christina is looking for an address. [Student was looking through an address book.] For her boyfriend's number!"

Another student defined *inference*. "It's a statement based on an observation."

Teacher W, seemingly ignoring the student's definition, said, An inference I could make is that for Christina there's something more important than what we're doing here. [By this time Christina was up out of her seat wandering around the room.]

Christina was ignored, and the teacher went on making a point about what one could infer about people who drive Rolls Royces.

It appeared to this observer that the teacher was making up his lesson plan as he went along. He had a pouch with numerous transparencies in it. He selected one which began, "Too many things in modern life lead us away from active and creative thinking. Nothing is more to blame than television." Students were to write at their seats the following four sentence completions:

(1). The author says that

(2). The facts and claims are

(3). The author uses words that

94

(4). The author wrote this passage to

The teacher got back to Christina. "I guess I'm being sarcastic. I guess I am."

Another student said, "You're in a bad mood."

Teacher W: "I guess I am. I shouted at a lady who I thought didn't know how to drive on the way to work. I knew I was in a bad way."

Student: "I'm asking you a question."

Teacher: "I'm trying to evade it."

Suddenly Teacher W pulled pictures of European architecture from his pouch of transparencies. "What were we doing Friday? Gargoyles. Just quickly, you have to touch things many times to make them yours. Sorry to be suggestive. . . . Shall I tell you everything I know about toilets? There were not flush toilets when they built Notre Dame." Thus it went for the rest of the hour.

Profile X (218)

Entering education from a sales engineering position for a plastics company, Teacher X has had eight years of teaching experience, seven of which he was uncredentialed. The subject area in which he was best prepared was physics. He teaches physical science, physics, and serves as the baseball coach. Teacher X attended an International Baccalaureate Conference within the last five years during which one full day was spent on critical thinking.

When asked to describe his concept of critical thinking, Teacher X said,

"the ability to apply concepts that you've learned throughout a variety of different ways of expressing yourself." Teacher X felt it was more important to apply pieces of several concepts than to answer questions about any one concept. He said that he felt critical thinking was application and analysis. When prompted with a question about how he would distinguish whether or not these processes are being done critically or uncritically, Teacher X replied,

> It's the job of every educator to make critical thinking a part of what they're doing in their class, everything from first grade up to nuclear physics at the college level. I haven't studied the standards myself. . . . It should be an integral part of not necessarily every lesson, but certainly the end result.

Because Teacher X was vague and wandered from the question, he was rated as having a limited conception of critical thinking.

When asked what he did in a typical day in class that fosters critical thinking, Teacher X continued in what for this researcher was a vague answer. "My basic goal for every class is to make some kind of critical thinking out of it." Teacher X believes that in his lessons he asks questions rather than providing "some concept that you can regurgitate at some other point when they ask you from memory what it was." Teacher X uses leading questions, "questions which you ask at the beginning which cannot be answered unless you participated in the lesson itself." Teacher X reports that he uses question asking throughout rather than just lecture. He "manipulates the answers of the students towards the concept you're trying to teach them." One of the problems with this answer is that just because a teacher is asking questions, that does not necessarily mean that a student is thinking critically, especially when the teacher is "manipulating the answers."

96

Teacher X reported that his personal conception of intellectual standards involved student inquisitiveness and satisfaction regarding what's being told to them. He said he valued student discovery rather than students' hearing all of their instruction from the teacher. The problem with using these qualities as standards is that any tyrant or terrorist could be inquisitive, could enjoy what he was doing, and could be discovering new ways to kill people, but that does not make what he is doing worthwhile. Such standards as relevancy and sufficiency need to be considered as well as intellectual traits of mind such as integrity and fair-mindedness.

Teacher X rated his teacher preparation for critical thinking a low 1 or 2 for content, but a 4 or 5 for desire. His education professors really wanted him to do critical thinking. They just never showed him how.

For the observation, Teacher X allowed this researcher to sit in his second period Physical Science class. The room was set up in science lab arrangement—three rows of long connected tables. This researcher felt intimidated by Teacher X's harshness and even sarcasm to the students. One girl came into the class with an enrollment slip, and he said, "Not another student in *this* class?" During recitation of yesterday's lesson review, Teacher X said to a student, "Miguel, since you talk every morning, tell us what rotation is."

At one point Teacher X encouraged a student to persevere through a brief line of questions in which he finally guessed the right answer, the rote answer Teacher X wanted. A video was shown in which the students were minimally engaged. They looked bored. A pop quiz of three questions followed with

97

students grading other students' work on the pop quiz afterward. A point system was explained. After ten minutes of whole class lecture, question–answer followed where Teacher X answered his own focus question that was written on the board, "Why Feb. 29th?"

Once when asked a question, a student replied, "Don't know." The teacher answered, "Are you willing to try?" The student did not answer, and the teacher went on to his next "volunteer." Two homework questions required students to individually do some reflecting on what if?, what would you do? and draw and explain. They would have been perfect for student interaction, but were assigned for individual homework. There was very little student interaction in this class. Every activity was completely dominated by the teacher. There was no misbehavior, everything quiet and compliant.

After class, Teacher X revealed that Friday he was going to take the class to the football field to act all of this out with the planets, rotation, and so forth. He further described a Creative Expression Project he was planning to assign the students. Those would be fine activities, but not necessarily related to critical thinking.

Profile Y (206)

Teacher Y entered education seven years ago from the field of opera singing. He is teaching ninth and tenth grade English, although the field in which he is best prepared is music. He reported that he had read numerous articles on

critical thinking in the last five years, although when asked, he could not mention any of them, or any scholar he read in the field.

With regard to his concept of critical thinking, Teacher Y said, "Critical thinking to me would be taking a basic subject matter beyond its face value and putting it into practice in various situations—practical application and processing of the material at hand instead of rote memorization." The vagueness of his answer reflected an unclear concept.

When asked about what he did that fosters critical thinking on a daily basis, Teacher Y spoke of extended writing and projects like letter writing and job applications—even grant applications for computers, and art, but he never clearly indicated how he regularly focused on thinking daily.

When prompted about accuracy as a standard for critical thinking, Teacher Y was unable to come up with any other examples. He wanted to come back to that one. When the interview did return to standards, Teacher Y added a comment about peeling off layers in character analysis. This researcher was unable to understand clearly what he meant, nor was he able to extract more specific information. Teacher Y rated his teacher education program for developing critical thinking in his students at a very low 2 on a 6 scale.

The class which was observed for Teacher Y was a regular freshman and sophomore English class. The class began with students writing grammatical corrections at their seats to the sentences on the board. There was a lot of distraction and students speaking out during this activity. The teacher kept interrupting to give instructions. One of the sentences was the following, "My

sister she hasnt never missed wild america a nature series on Public Television every. Thursday at 7:00 PM." After a few minutes of seat work, volunteers came to the board to make corrections.

The majority of the period was spent in some kind of art project which depicted something about their heritage. Students worked in groups of two or three on quilt squares. Lots of students were not engaged. Students were off topic, some with their heads down on the desk. One new student came into the room and sat unoccupied at his desk, just as lost as this observer was, for ten minutes. He was eventually given a story for silent reading.

Teacher Y was obviously trying to reach students where they are, but one whole period on designing a quilt square seemed demeaning. Many appeared to be very bored.

Profile Z (205)

Teacher Z, a second year history teacher and coach, had not attended any conferences on critical thinking in the last five years. Some of his answers were vague. Others reflected some misconception. When asked what his conception of critical thinking was, he replied, "the ability for individuals to analyze and evaluate a particular topic." When given the prompt concerning standards of how he knew his students were analyzing and evaluating critically or not, he replied, "That's difficult. There are certain processes in education that allow an instructor to evaluate that and to assess critical thinking. One is through writing." In a further

prompt, Teacher Z was asked what he was looking for when evaluating the writing. He replied that he looked for whether the student was on the topic, whether the writing was coherent and expressed in an objective fashion and then followed up with a subjective analysis. No doubt this teacher would object to a student's writing that was inaccurate and shallow, but he did not mention these standards in his answers. Teacher Z said that he had no problem not covering content, because "critical thinking is why we're there to teach," but without a clear concept of what critical thinking is, students may miss the point of education. Students need to know how to think about the content covered.

When asked about what he does on a daily basis to foster critical thinking, Teacher Z indicated that he has his classes organized into groups called History Circles. Within these circles, the students talk about what they have read and write about what they have read. He spoke of assigned jobs that each member of the group had, but he was very vague about what those jobs were and how just sitting together, talking and writing, would all come together for an individual student to think critically about what was assigned for reading. It would depend on the assignment and how the students engaged and interacted with each other. This researcher was not confident that Teacher Z had a clear picture of how to make that happen.

When asked to share his personal conception of intellectual standards, Teacher Z was given the prompt about giving advice to a student who needed to know whether to accept or reject some editorial. "I wouldn't give them too much advice. I would not tell them what to think. I would expect them to come up with

101

the answer. I think that many times our teachers are telling their students what to think instead of having them think through it. I would help." This observer asked then, "And when a student gave you the benefit of his thinking, what would make you think he had done a good job of thinking?" Teacher Z replied, "Is the student making a valid attempt to come up with an intellectual answer to the question at hand?" Perhaps Teacher Z was arguing from the purist form of Constructivism, but he was not articulating universally accepted standards, such as clarity, relevancy, depth, and breadth. Pupils may persist in shallow thinking without instruction in the standards of good thinking. Teachers should require those standards of their students and show them how to require those standards of themselves.

Several weeks after his interview and observation, Teacher Z provided job assignment descriptions of the History Circle job assignments. They included discussion director, whose job it was to develop a list of questions that the group might want to discuss about the assigned reading; the visualizer–illustrator, who was to draw a kind of picture related to the reading; the, connector, who was to find connections between the assignment and the outside world; the luminary, who would select a few special sections of the text to read aloud to the group; and the summarizer, who was to prepare a brief summary of the reading assignment. These job assignments would change daily as the students came into the room. In order to make an A in this activity, the student had to fulfill the following requirements:

- prepare forms for discussion before the discussion

- not write during the discussion

- appear to be engaged in an actual discussion

- refer to the discussion forms, but not read from them

- participate by listening, talking, and acknowledging good points

- continue to talk for the entire discussion period

- show evidence in written work of higher level thinking

- turn in paperwork that is neat and on time

- show an energetic, positive attitude

Although the job assignments and rubric lend some structure to the class, it is not immediately apparent how this structure will foster critical thinking. Students are encouraged to "discuss" the questions developed by the discussion director, but there did not appear to be any standards for discussion. Some groups could remain on a surface level, simply talking about what they liked or disliked. As Richard Paul states (1995), "collaborative learning is likely to become collaborative mis-learning" (p. 95). This approach would require regular alternative teaching methods and accountability to sustain it over the course of a school year.

Teacher Z rated his teacher preparation program to develop critical thinking in his students at a 2 on a 6-point scale. He was weak in his conceptualizing the basic skills of thought necessary for critical thinking. He did not mention important intellectual traits of mind. His conception of student reasoning within his subject area was not well developed. There was not much emphasis on problem solving, on the special need for critical thinking today, or on the need for a greater emphasis

on peer and student self-assessment.

The class observed of Teacher Z was an eleventh-grade U. S. History class with 32 students. While the teacher was encouraging students to think critically in the context of the content being studied, activities or strategies specifically designed to actively encourage students to do so were not there. The students were just then, a month after school started in the fall, being introduced to the History Circle concept. The groups were not yet operating, but by the end of the class Teacher Z indicated that he would get them started on their group job assignments. Unfortunately, after building the students up to begin the group activity, Teacher Z got to the end of the period and put group work aside until the next day.

Class began by students in their group configurations reading the textbook silently and writing the answers to the questions at the end of the chapter. This activity was accomplished without students talking with the other members of their groups. Following the seat work, which consumed about half the class, the teacher passed out the job assignment sheet for the visualizer, and everybody in the group was to be a visualizer that day. The visualizer was to "draw some kind of picture related to the reading" which they had just done. The students were encouraged to "color it and make it look good." One student asked, "what are we supposed to do?" Teacher Z replied, "Draw anything interesting or thought provoking. . . . Don't copy out of the book. It doesn't help you to do something someone else has done. You can do this. I know you can."

Following the drawing, the students were to answer in writing the

following questions: What is your drawing of or about? Why did you choose to illustrate this scene or idea? Why is this an important part of your textbook? Students were never given the opportunity to share their drawings with the other members of their groups. The students did not appear to be excited about what they were learning. This observer wondered whether the students were discovering anything or just putting down something they thought the teacher wanted.

CHAPTER V

ANALYSIS AND CONCLUSIONS

In this chapter the data will be analyzed as it applies to each research

question. Conclusions will be drawn, and recommendations will be made. With

the exception of table 14, all findings and references to statistically analyzed data in

this chapter are from the randomly selected sample only, that is, from teachers the

author randomly selected from staff lists (*random*) and from teachers the author

randomly selected but the principal also later recommended (*both*). Although

findings for the entire sample of 40 teachers are nearly identical to those for the

random sample, in order to provide greater generalizability, responses from the

purposive and *volunteer* samples are not included.

Analysis

Research Question 1: To what extent do high school teachers engage in reasoned
discourse in their instruction?

When asked, "Is there anything you do on a daily basis in the classroom

that you believe fosters critical thinking?" 62% of the teachers had little or limited

conception as supported by vagueness, misconception, and wandering from the

question or contradiction.

However, 58% gave an elaborated conception of why they felt critical

thinking is the focus of instruction. Some of them said, "Critical thinking *is* the instructional work." They were articulating a view that all of their instruction should center around critical thinking. They did not agree with the position of some teachers who feel that they have too much other instructional work to do in order to have much time left for fostering critical thinking.

Teachers had difficulty articulating critical thinking skills they wanted their students to develop. As many as 58% of the teachers had little or limited conception or vocabulary to talk about critical thinking skills.

However, when teachers were observed in the classroom, students were in some fashion encouraged to clarify the question; the mean on a 6-point Likert scale was 4.1. Students were encouraged to gather relevant data; the mean on a 6-point Likert scale was 4.5. Students were encouraged to reason to a valid solution; the mean on a 6-point Likert scale was 4.2. Students were held to a high degree of precision and accuracy in reasoning; the mean on a 6-point Likert scale was 4.4.

Unwilling to assess their colleagues or unable to do so, 58% of the teachers had limited conception or no conception as to how they would assess a teacher's ability to foster critical thinking through her instruction. Several teachers would not answer this question or said they did not know.

Only 42% could clearly explain the difference between an assumption and an inference. Only 17% could clearly explain the difference between an inference and an implication.

In order to establish reasoned discourse within a classroom, a question was

Table 11

One-Way ANOVA of Independent Variable Achievement Level on Selected Dependent Variables.

| Variable | | Means | | Tukey HSD | Statistically significant |
	Basic	General	Honors	F Prob.	difference between
Reasoning w/in subject					
(c3)	1.7	3.9	3.5	.02	Basic and General*
Peer and student					
self-assessment (c6)	1.0	2.8	1.7	.04[a]	Basic and General*
Clarifying the question					
(paul1)	2.5	4.0	5.2	.01	Basic and Honors*
Gathering relevant					
data (paul2)	3.5	4.7	4.9	.08	Basic and Honors[#]
Alternative					
viewpoints (paul6)	3.3	2.5	4.5	.045	General and Honors*
Challenging					
work (paul8)	2.2	4.0	5.2	.002	Basic and Honors*
Fair-mindedness					
(paul11)	2.2	3.1	4.4	.08	Basic and Honors[#]
Thinking w/in					
discipline (paul12)	2.7	4.5	5.1	.04	Basic and Honors*
Standards					
(paul13)	3.2	4.2	5.0	.09	Basic and Honors[#]

Notes. N = 27. [a]Kruskal-Wallis Test (H) for non parametric data. *p<.05. [#]approaching statistical significance: p<.10. Likert scale: 1 = *not mentioned* to 6 = *elaborated*.

The issue that this finding raises is equity. Why should those in the basic classes have any less opportunity to learn to think critically than those in the honors

classes? Is there any policy reason not to expose the basic classes to the same level of critical-thinking instruction as the honors? Some of the teachers in the study indicated they had demonstrated that it could be done with very average or basic classes. The deficiency lies in teacher education. Many teachers indicated they did not know how, nor had they been taught how, to engage basic students or low achieving readers in critical thinking. One teacher said, "Very little critical thinking is happening in schools. It is hard for them to think deeply. Just following instructions is the main focus these days."

Levin and Chasin (1994) make a case for all students receiving the same level of instruction. "Accelerated Schools were designed to advance the learning rate of students rather than slowing it by transforming instruction from a remedial approach to a gifted and talented one. . . . Research has found that acceleration and enrichment work for all students" (pp. 3,4).

Each of the mean responses in Table 11 refers to a 6-point scale (1 = *not mentioned*; 6 = *elaborated*). The questions addressed in each of the variables in Table 11 are as follows:

- The interviewee did–did not mention teaching to facilitate reasoning within the subject, such as teaching for historical thinking, sociological thinking, mathematical thinking, biological thinking, scientific thinking, philosophical thinking. (c3)

- Are students encouraged to clarify the question? (paul1)

- Are students encouraged to gather relevant data? (paul2)

- Have students entered accurately into alternative viewpoints? (paul6)

115

- Intellectual perseverance. Does the classroom involve intellectually challenging work that requires students to persevere? (paul8)

- Fair-mindedness. Are students encouraged to treat each other alike without reference to their own feelings or interests? (paul11)

- Reasoning within the subject. Is there an atmosphere of thinking within a discipline (e.g., mathematical thinking)? (paul12)

- Intellectual criteria and standards. Were there any references during the classroom observation to universally accepted intellectual standards for critical thinking (e.g., relevancy, accuracy, precision, depth, sufficiency, logic, clarity, consistency)? (paul13)

As might be expected, there was a substantial relationship (Pearson r = .68) between c3 and paul12. That is, there was substantial correspondence between whether teachers mentioned reasoning within a discipline in their interview and whether it was observed in the classroom. Teachers of basic classes were less apt to articulate and demonstrate this concept than teachers of general and honors classes. The means are lower for c3 than for paul12, which indicates that teachers were more apt to demonstrate reasoning within a discipline than they were to articulate it.

Comparison of Means of Selected Dependent Variables by Background Independent Variables. (Interview Data)

Table 12 reports findings for background distribution differences by selected dependent variables from the coded interview questions. See Appendix A

116

for the specific questions referenced. These variables were chosen from the

interview protocol because they are summary questions. Further, these questions

were given a 6-point response choice which yielded data more precisely analyzed

than the categorical responses for the other interview questions.

Table 12

Comparison of Means of Selected Dependent Variables by Background
Independent Variables. (Interview Data)

| Dependent variables: | Independent variable means | | | |
	Subject science/other	Experience (<5yrs / $5+$ yrs)	Gender (m / f)	Entered from outside education (yes / no)
Skills (c1)	4.2/3.5	3.5/3.6	3.3/3.9	3.4/3.8
Traits (c2)	3.4/2.4[#],[a]	2.3/2.6	2.0/3.0	2.6/2.5
Within a subject (c3)	3.4/3.2	2.8/3.7	2.7/3.8	2.4/3.9*,[a]
Problem solving (c4)	4.0/3.7	3.7/3.8	3.7/3.8	3.8/3.8
Importance today (c5)	4.2/2.7	3.2/2.9	2.8/3.1	3.2/2.7
Peer and self-assessment (c6)	2.0/1.9	2.0/1.9	1.7/2.1	1.8/2.0

Notes: $N = 31$. [a]2-Sample Independent t Tests. *$p<.05$. [#]approaching statistical significance: $p<.10$. Likert scale: 1= *not mentioned* to 6 = *elaborated*.

The researcher chose to dichotomize the samples for the variables in this

table and to use a 2-sample Independent t Test to analyze the results. For the

summary interview questions, it appeared that science teacher means were

117

consistently somewhat different from the other subject areas; therefore, the subject variable was separated into two samples: science and other. The experience variable was separated into two samples: those with five years or less of teaching experience and those with more than five years of teaching experience.

Two sets of statistically significant differences[5] appeared in analyzing the data for Table 12. A statistically significant difference resulted between teachers who entered education from another field and those who did not on the variable reasoning within a subject (c3). Those who entered education from another field had lower means.

A statistically significant difference resulted between science teachers and other teachers in articulating important traits of mind. The science teachers had higher means.

Comparison of Means of Selected Dependent Variables by Background Independent Variables. (Observation Data)

Table 13 reports findings on background distribution differences by selected dependent variables from the Paul-generated observation questions in the observation protocol (see Appendix B). This researcher chose the Paul questions because they required more specific responses than the other observation instruments.

The researcher chose to present a similar dichotomy of the samples for the variables in Table 13 as to that in the previous table. A 2-Sample Independent t Test was used to analyze the results. Class size is separated into classes of 30 or more and less than 30.

118

Table 13

<u>Comparison of Means of Selected Dependent Variables by Background</u>
<u>Independent Variables. (Observation Data)</u>

| Dependent variables: | Subject science/other | Independent variable means | | Gender (m / f) | Entered from outside education (yes / no) |
		Class size (<30 / 30+)	Experience (<5yrs / 5+ yrs)		
Clarifying the question (paul1)	3.0/4.4	4.3/4.0	4.0/4.2	3.8/4.4	3.7/4.5
Gathering relevant data (paul2)	4.6/4.5	4.5/4.5	4.2/4.6	4.3/4.7	4.3/4.7
Reason to valid solution (paul3)	4.6/4.1	3.9/4.4	3.2/4.5	3.8/4.6	3.6/4.7[#,a]
Discussion of assumptions (paul4)	2.0/2.1	1.4/2.6	1.8/2.1	2.1/2.1	2.0/2.1
Implications discussed (paul5)	1.0/4.0*,a	3.5/3.5	2.4/3.7	3.6/3.4	2.9/3.9
Alternative viewpoints (paul6)	2.2/3.8	3.6/3.4	2.2/3.7	3.8/3.2	3.3/3.7
Humility (paul7)	2.0/3.0	2.7/2.9[#]	2.0/3.0	2.7/2.9	2.3/3.2
Challenging work (paul8)	3.0/4.3	4.4/3.9	3.4/4.2	3.8/4.3	3.4/4.6
Precise & accurate (paul9)	3.8/4.5	4.9/4.1	3.4/4.6	3.8/4.9	4.0/4.7
Integrity (paul10)	2.0/3.4	2.5/3.6	2.0/3.4	3.5/2.8	2.8/3.4
Fair-mindedness (paul11)	2.8/3.5	3.6/3.3	2.6/3.6	3.5/3.3	3.6/3.3
Thinking within discipline (paul12)	4.2/4.4	4.3/4.4	3.6/4.5	2.3/1.5*	3.6/4.9
Standards (paul13)	3.4/4.5	4.5/4.1	3.2/4.5	3.9/4.6	3.8/4.7

Notes: N = 27. [a]Mann-Whitney U Test. All others are 2-Sample Independent t Tests. *$p < .05$.
[#]approaching statistical significance: $p < .10$. Likert scale: 1 = *not mentioned* to 6 = *elaborated*

119

Four sets of statistically significant differences[5] appeared in analyzing the data for Table 13. A statistically significant difference resulted between teachers who entered education from another field and those who had not in observing whether their students reasoned to a valid conclusion or not. Teachers who entered education from another field had lower means.

A second statistically significant difference resulted between science teachers and teachers of other subjects in observing whether their students discussed the implications of conclusions. Science teachers had lower means.

A third statistically significant difference resulted between teachers with class sizes less than 30 and those with class sizes of 30 or more in observing whether their students identified what they did not know as well as what they did know. Teachers with lower class sizes had lower means. A fourth statistically significant difference resulted between male and female teachers in observing whether there was an atmosphere of thinking within a discipline in their classrooms. Females had lower means.

Only a few of the differences reported in Tables 12 and 13 reached statistical significance; the ones that did reach statistical significance could have been the result of chance alone. However, certain patterns of response were evident which might have produced statistically significant differences if case sizes had been larger. First, for every experience-related comparison shown in Table 13, the mean for teachers with greater than five years of experience was higher that those with less experience. Second, with the exception of one variable in Table 13, the mean for teachers who did not enter education from another field was higher than the

mean for those who did.

Typical Day and Standards. A substantial relation was found between distributions of two interview questions. Those who could articulate at some level a description of a typical day in class that fosters critical thinking could also articulate at some level a personal conception of intellectual standards (Spearman r = .60).

Teacher Preparation. When asked, "On a scale from 1 to 6, how well do you feel you were prepared by your teacher education program to develop critical thinking in your students? One is no preparation. Six is great preparation" (i9), the average response was 2.8, in the low end of the scale. Few teachers in the study rated their teacher preparation very high. No one rated it a six. Only seven rated it a five. Further, there was no relationship between distributions of this teacher preparation question (i9) and any of the Paul questions in the observation protocol (see Appendix B). That is, teacher self-perception of teacher education did not correlate positively or negatively with what they were doing in practice. Teachers who rated their teacher education in critical-thinking instruction high did not consistently rate high or low in performance. In fact, an argument could be made that teacher education in critical-thinking instruction had no influence on practice.

A follow-up letter was sent to 12 of those interviewed and observed among the group who articulated and–or demonstrated exemplary practice in critical-thinking instruction. One of those was from the purposive sample. One was a volunteer. These are so noted. It was pointed out to them that one of the most important findings of the study is that teachers did not rate their teacher education

121

programs very high in preparing them for fostering critical thinking in their students. Even though they may have ranked their teacher education program higher than the mean, they were asked to respond to this follow-up question: Who or what, other than your teacher education program, were the most significant influences on your ability to foster critical thinking in students? They were asked to answer by circling a number from 1 to 6 which best described to what degree certain influences had on their critical thinking. One is little influence. Six is great influence. They were then asked to give a narrative as to how factors marked 5 or 6 influenced them. Table 14 reports the responses to the scale selection. Only randomly selected teachers are included in Table 14. Following the table, the narratives are given.

Combining what these twelve teachers said during their interviews and observations with what they wrote on the follow-up questionnaire, the following findings concerning what influenced them to use critical thinking methods in their instruction emerged.

Among the teachers with the highest profiles (see chapter IV), most reported during their interviews that they learned to foster critical thinking in their students by their own experience, either personally or in teaching. One teacher reported strong departmental support for critical thinking. None reported strong support from administration for critical-thinking instruction.

Table 14

Influence Responses from Teachers Who Articulated and–or Demonstrated
Exemplary Practice in Critical-Thinking Instruction

Influence	Mean	Number who rated 5 or 6
An administrator who set the school climate for critical thinking	1.4	0
A department chair or colleague	2.1	2
Journals, books, or workshops	4.2	4
A student or students	3.1	3
My own personal upbringing and home life	4.3	5
My own thinking and research	5.4	8
A career prior to education	1.9	1
Other*	n/a	3

Note. N = 9; 8 *random* and *1 purposive*. *The "other" responses were: an undergrad teacher 50 years ago and a manager while in industry; use of a questioning approach because he thought it was right; being a committee member - State Department of Education; background in theatre and journalism. Likert scale: 1 = *little influence* to 6 = *great influence*.

Teacher A (318) reported that she got her education in critical thinking in the home. On her follow-up question, she rated students, her own personal upbringing and home life, and her own thinking and research as the greatest influences. Concerning each she wrote:

> Students: I realized (almost immediately) that my students *needed*
> to think more critically, not just in order to master a course of study,
> but primarily to function productively in life.
> Personal Upbringing: I was raised in a home where reading and

discussion, analysis were expected. My mother stressed examination of issues (from the Bible to newspapers!) and encouraged us to be independent thinkers.

My Own Research–Thinking: Once I determined that I would develop critical thinking in my students, I sought means to teach these skills. I read about current brain studies and multiple intelligences, and so forth. I devised games that students could play as a fun way to encourage and nurture critical thinking.

Teacher B (202) learned to think critically as a chemist at Dupont many years ago. He ranked his own thinking and research, a career prior to education, and under other—an undergraduate teacher 50 years ago and a manager while in industry, as having the greatest influences. He wrote:

- My college freshman English teacher, [proper name], had a forever influence on my thinking and teaching methods. He did not lecture but asked probing questions and would not accept a nonanswer. Even the most dead head students responded positively.
- One of my supervisors at Dupont formulated our product development program based on key questions we generated in our research specialties. Even after he was promoted the program continued at a lively pace without direct supervision.
- My career in R & D and tech service taught me the value of critical thinking and the use of probing questions.
- Recently I took a course at Landmark Education (The Forum) which also utilized the probing question.

Teacher C (502), a purposively sampled teacher, learned to teach critical thinking from teaching. She credits such workshops as the Literature Project with giving validation to what she had already concluded. She said it took her a long time to learn it by trial and error.

Teacher D (214) rated workshops, her own thinking and research, and students as the greatest influences. Concerning each she wrote:

Workshops: (1) History Project—for 3 summers on college

124

campuses. Lots of dialog.

(2) 1274 Regional Project—Lots of reading, discussion, activities—6 years.

<u>Personal Research</u>: My religious studies have taught one to question, reason, evaluate.

<u>Students</u>: 13 years of experience—seeing them.

Teacher E (401) reported that she graduated from the University of Minnesota in 1969 when the Inquiry Method was big. On her follow-up questionnaire she rated books, workshops, and her own thinking and research as having the greatest influence. She wrote:

> I have attended numerous workshops through the years, and they have taught me a great deal about critical thinking. I know that students learn differently and think at different levels. I also know that encouraging students to think at increasing higher levels is vital for their success in college. Thus, many lessons can have critical thinking components—from analysis of a picture to analysis of an article. Teacher Curriculum Institute materials have also been great for giving me ideas about how to teach critical thinking.

Teacher F (410), a second year teacher, rated her teacher preparation program with regard to critical-thinking instruction at a 5 on a 6-point scale. However, she was only one of seven who ranked their teacher preparation programs this high. Five of the others who ranked their programs this high did not articulate or demonstrate a clear concept of critical-thinking instruction. The seventh, Teacher L (510) received her teacher education in another state 17 years ago. Teacher F wrote,

> My background in science and my undergraduate experience greatly influenced my belief that critical thinking is important. I have learned to constantly take in information and analyze it. For me, this is a way of understanding the world. Partly, I believe this is my personality and based on my home life. My professors, as an undergrad, also fostered my development because they all stressed

that there must be information or data to support a conclusion.

Teacher G (209) wrote, "I've just used a questioning approach to teaching because I thought that was the way to do it." Teacher G rated every category in the survey at a 1 except his own thinking and research which he rated a 5.

Teacher H (405) wrote,

I have found workshops around Southern California as the greatest source of critical-thinking instruction. Our district mentors provide many very sound instructional workshops. Others would be AP conferences, Social Services in Culver City had some very good Saturday workshops. My parents coming from China inspired myself to question many of the issues for minorities in America, which I find the most enjoyable part of teaching U. S. History.

Teacher I (215) reported that she learned to teach for critical thinking in Ireland where she was raised. "It's the way we learned in Ireland." She reported that she got no departmental support for teaching this way, but the textbook that was selected encourages critical thinking.

Teacher L (510), a 17-year veteran English teacher ranked 5 of the items at a 5 or 6. Her responses are as follows:

Department Chair or Colleague: Influential in expanding the definition of "talented and gifted," and in so doing focused on *how* learners learn. What? When?
Journals, Books or Workshops: Provided hands-on experience in creating critical thinking activities at all levels. Provided opportunity for interaction with teachers and other educators.
A Student or Students: Since all classes of students are heterogeneously grouped, there is a natural setting for collaborative learning activities that offer all levels of thinking skills. Teacher provides material and motivates students to "stretch"—meet highest level of thinking possible. Learn from others as well as teacher.
My Own Personal Upbringing and Home Life: Examination and discussion of issues, newspapers, books, and magazines were

everyday occurrences. Family members politically active. Third
generation of teachers.

My Own Research–Thinking: Academic climate created through
research and participation in projects needing immediate feedback
with authors of educational material, books, experiments.

Other: As a committee member on reading standards, project
evaluation, teacher credentialing. Examined curriculum,
procedures, standards for teachers and students.

Teacher M (116) said he developed his critical thinking method of teaching

from other faculty at his high school and improved on it over his 12 years there.

He has a background in theatre and journalism where the seeds to explore and

understand were planted.

Conclusions

Key Findings of this Study

The results of this study appear consistent with the Paul, Elder, and Bartell

(1997) study. The resulting percentages from the interview questions were higher

in favor of the teachers in this study, but the results were identical. The following

implications from the Paul, Elder, and Bartell study (1997) are particularly

applicable to this one:

> From either the quantitative data directly, or from minimal inference
> from those data, it is clear that a large percentage of teachers
> interviewed (and, if representative, most teachers):
> • do not understand the connection of critical thinking to intellectual
>   standards.
> • do not specify intellectual criteria and standards.
> • inadvertently confuse the active involvement of students in
>   classroom activities with critical thinking in those activities.

127

- do not provide an elaborated articulation of their concept of critical thinking.
- do not provide plausible examples of how they foster critical thinking in the classroom.
- do not name specific critical thinking skills they think are important for students to learn.
- do not explain how to reconcile covering content with fostering critical thinking.
- do not consider reasoning as an important focus of critical thinking.
- do not think of reasoning within disciplines as a major focus of instruction.
- do not specify basic structures essential to the analysis of reasoning.
- do not give an intelligible explanation of basic abilities either in critical thinking or in reasoning. (p. 19)

Further statistically significant differences indicated in the summary data for the interviews were the following:

- A statistically significant difference resulted between teachers who entered education from another field and those who did not on the variable reasoning within a subject (c3). Those who entered education from another field had lower means.

- A statistically significant difference resulted between science teachers and other teachers in articulating important traits of mind. The science teachers had higher means.

The observation component of this study, however, yielded other signs of activity in the classroom that were not articulated in the interviews. The Paul, Elder, and Bartell study (1997) did not contain this observational component.

- Examples exist of exemplary practice in critical thinking in high school

128

instruction.

- Some teachers practice exemplary critical-thinking instruction without being able to articulate what they are doing.

- Students in honors classes are better served by critical-thinking instruction than those in lower achievement levels.

- Most teachers who demonstrated exemplary practice in critical thinking did not learn how to do it in their teacher preparation programs. The vast majority of them picked it up on their own through classroom experience or bringing the concept to education from some other field or from their upbringing.

- A statistically significant difference resulted between teachers who entered education from another field and those who did not in observing whether their students reasoned to a valid conclusion or not. Teachers who entered education from another field had lower means.

- A statistically significant difference resulted between science teachers and teachers of other subjects in observing whether their students discussed the implications of conclusions. Science teachers had lower means.

- A statistically significant difference resulted between teachers with class sizes less than 30 and those with class sizes of 30 or more in observing whether their students identified what they did not know as well as what they did know. Teachers with lower class sizes had lower means.

- A statistically significant difference resulted between male and female teachers in observing whether there was an atmosphere of thinking

129

within a discipline in their classrooms. Females had lower means.

The foregoing results were from differences in means. A further result came from comparison of means. Those who could articulate at some level a description of a typical day in class that fosters critical thinking could also articulate at some level a personal conception of intellectual standards.

These findings bring forward the issue of what constitutes good education. Good education is not just going through the motions of schooling, that is: taking role, having desks in neat rows, students present with the required supplies, and so forth. Good education does not even consist primarily of stated goals and objectives, as important as those may be. Good education is not just training students to give the proper response when stimulated in a certain way. Although some training is necessary in the basic knowledge of a discipline, training must always occur in the context of good education. Good education does not just *re*produce knowledge; it produces knowledge. Good education engages the students. Good education always emerges from students making meaning of their discoveries, and good education often enriches itself when the students leave the classroom. The students ask their own substantive questions and think independently based upon the ideas generated in the classroom. Students write, talk, and think these ideas into their own systems of life interpretation. If, however, the teachers do not provide the vocabulary or the framework for critical thinking, the students are not well-served in their educational experience.

130

Challenges of this Study

(1). The teachers who volunteered for the study may have already had an interest in critical thinking. Those who had no interest in critical thinking may not have volunteered. Of the 105 teachers invited to participate, 39 accepted. One volunteered who had not been invited (which brings the totals to 106 and 40; see Appendix C). Perhaps this explains why the interview results were numerically higher in favor of the teachers than were the results of the Paul et al. (1997) study. Yet, even with the higher value in each of the responses, the results, as has been cited earlier, did not significantly affect the outcomes which indicated parallel results between the two studies.

(2). Observing the classes later in the year for some cases may have yielded better results. The classes were just getting broken into a routine when they were observed in September and October of the school year. However, an argument could also be made that if there ever was a time to emphasize critical thinking, the beginning of the year is the time to do it. What is done in September and October sets the tone for the entire year.

(3). Teachers may have offered their best classes for observation and may have presented model lessons. This researcher encouraged the participants not to prepare a model lesson for observation, and in most cases the class that was observed was one that matched the schedules of both the teacher and the observer rather than one that was chosen for the achievement level of the class.

(4). Just observing one class period may not show one all that the teacher does. It may be unrealistic to expect a teacher to do every aspect of critical-thinking instruction every day. Further, there are routines and hidden aspects of the class culture that the observer may not have been aware of. However, a strength of the observation design of this study may have been that every teacher had an equal opportunity. Some teachers may have done worse than their norms on the day of observation, but others may have done better. No observer in any classroom setting can see and hear everything, not even the teacher herself. Aware of this limitation, this observer prepared himself through a summer course of study to gain skills in observational technique.

(5). A well-validated measuring instrument was used, and care was taken in implementing the measures. In some instances the classroom situation was difficult. Classroom discipline may have been a problem. However, it was not the intent of this observer to make teachers look bad or good. This observer simply reported what he saw.

Implications

(1). All teachers need to be educated in the standards, intellectual traits, skills, and processes of critical thinking in their preservice education. Teachers are not being served well by their teacher education programs in the area of critical thinking at the university level. New thinking needs to impact the course methodology and content required for certification.

(2). All teachers need to be educated in the standards, intellectual traits,

skills, and processes of critical thinking in their in-service education. County offices of education and local districts would do well to provide opportunities for teachers to deepen their understanding and perfect instructional strategies that promote critical thinking.

(3). In both preservice and inservice education, teachers need opportunities to learn the nomenclature of critical thinking. Although some teachers are demonstrating exemplary practice in critical-thinking instruction, they generally have not had the education to articulate clearly what they are doing. Therefore, they are not providing students with the vocabulary to conceptualize their own thinking.

(4). Teachers need opportunities to think about the philosophy of critical thinking. They not only need to be aware of current research in how people learn and think, but they need to learn what their own philosophy of thinking is. The philosophical history of critical thinking is rich in clues for better student learning methods. Teachers need to think about what knowledge itself is in intellectual, psychological, sociological, ethical, and philosophical contexts.

(5). A concerted effort needs to be made to assure that all students, regardless of achievement level, be given the opportunity to learn to think critically.

(6). Critical thinking should become an organizing core for other school reforms. Instead of viewing critical thinking as just one more educational reform, it needs to become the center from which all other reforms generate.

(7). Textbooks need to have more critical thinking language and open-ended questions. Too many texts have chapters with end quizzes that require only

superficial memorization of information. Textbooks must provide more opportunity for student-centered discovery that promotes reasoned discourse.

Recommendations for Further Research

(1). The Paul et al. (1997) study addressed the teacher preparation institutions. This study addressed high schools. For future study the next step is to do interviews and observations at the middle school or junior high level. The same interview protocol should be used. It has proven its value in both studies. The Paul observation questions would be more productive for future research than the others used in this study.

(2). Two missing elements in this study could be addressed with case studies. First, the researcher had no access to student records. Measuring how student performance changes over a period of time when students are exposed to critical-thinking instruction would be useful information. What strategies work best? Is learning retained better with critical-thinking instruction? Secondly, a case study would allow a teacher to be observed more than once or twice. Teachers identified in this study, known to articulate and–or demonstrate exemplary critical thinking methods at the high school level would provide excellent information for long-term case studies. Such a study could look at student records and observe the teachers' classes several times over a semester.

134

<center>NOTES</center>

[1]All statistically significant differences are at the 0.05 level.

[2]Paul (1997a, pp. 3-27) lists the following as universally accepted intellectual standards for critical thinking: relevancy, accuracy, precision, depth, sufficiency, logic, clarity, consistency.

[3]Paul (1997b) lists the following analytical inferential skills associated with critical thinking: formulation and assessment of: purposes, questions, inferences and interpretation, information, concepts, assumptions, implications and consequences, point of view. Paul describes these skills as the elements of reasoning.

[4]Paul (1995, pp. 316, 317) lists the following intellectual traits associated with critical thinking: intellectual humility, courage, empathy, integrity, perseverance, faith in reason, and fair-mindedness.

[5]Two different significance levels are reported in Tables 11-13. The first is at the .05 level, indicated with a single asterisk (*). The second is approaching statistical significance at the .10 level, indicated with a pound symbol (#).

REFERENCES

Allen, R. (Ed.). (1991). *Greek philosophy: Thales to Aristotle*. New York: The Free Press.

Baron, J. (1987). Evaluating thinking skills in the classroom. In J. Baron and R. Sternberg (Eds.), *Teaching thinking skills: Theory and practice* (pp. 221-248). New York: W. H. Freeman.

Bloom, B. (Ed.). (1956). *Taxonomy of educational objectives: The classification of educational goals*. New York: Longman.

Christensen, C. (1993). The use of critical thinking skills in the elementary and high schools of the Omaha Public Schools. *Dissertation Abstracts International, 54* (09), 3306A. (University Microfilms No. AAI9406075).

Costa, A. (1985). *Developing minds: A resource book for teaching thinking*. Alexandria, VA: Association for Supervision and Curriculum Development.

Costa, A., and Garmston, R. (1994). *Cognitive coaching: A foundation for renaissance schools*. Norwood MA: Christopher-Gordon Publishers.

Cotton, W. (1997, September 15). *Toward re-visioning the meaning of education in a post-modern age: Thinking, language, and the human project*. Manuscript submitted for publication.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process*. Lexington, Massachusetts: D.C. Heath.

Educational Testing Service, (1995). *Teacher performance assessments: Assessment criteria*. Princeton, NJ: Educational Testing Service.

Elder, L. (1997a, March 19). Collaborative learning, collaborative mislearning. *Education Week*, p. 45.

Elder, L. (1997b). The new standards. *Community College Times, 9* (5), p. 1.

Ennis, R. (1996). *Critical thinking*. Upper Saddle River, NJ: Prentice Hall.

Ennis, R. and Millman, J. (1982). *Cornell critical thinking test, level Z*. Champaign, IL: Illinois Rational Thinking Project.

Fisher, R. (1990). *Teaching children to think*. Oxford, England: Basil Blackwell.

Fraker, D. (1995). *Improving high school students critical thinking skills*. (ERIC Document Reproduction Service No. ED 391 725).

Fullan, M. (1991). *The new meaning of educational change*. New York: Teachers College Press.

Giroux, H. (1994). Toward a pedagogy of critical thinking. In K. Walters (Ed.), *Re-thinking reason: New perspectives in critical thinking* (pp. 199-204). New York: SUNY Press.

Goodlad, J. (1984). *A place called school: Prospects for the future*. New York: McGraw-Hill Book Co.

Goodlad, J. and Klein, M. (1974). *Looking behind the classroom door*. Worthington, OH: Jones.

Goodlad, J., Sirotnik, K., & Overman, B. (1979). An overview of A study of schooling. *Phi Delta Kappan, 61*, 174-178.

Hendricks, K., Newman, L., & Stropnik, D. (1995). *Using higher order thinking skills to improve reading comprehension*. (ERIC Document Reproduction Service No. ED 398 538)

Jackson, P., Boostrom, R., & Hansen, D. (1993). *The moral life of schools*. San Francisco: Jossey-Bass Education Series.

Julyan, C., & Duckworth, E. (1996). A constructivist perspective on teaching and learning science. In C. Fosnot (Ed.). *Constructivism: Theory, perspectives, and practice* (pp. 55-72). New York: Teachers College Press.

137

Kemp, S. (1988). The effects of instruction in forming generalizations on high
    school students' critical thinking in world history. *Dissertation Abstracts
    International, 49* (11), 3318A. (University Microfilms No. AAD89-
    03361). WorldCat Accession: 20085013.

Kennedy, M. (1991). Policy issues in teacher education. *Phi Delta Kappan 72,*
    659-664.

Lester, J. (1996). Is the algorithm all there is? In C. Fosnot (Ed.).
    Constructivism: Theory, perspectives, and practice (pp. 145-152). New
    York: Teachers College Press.

Levin, H., and Chasin, G. (1994). *Thomas Edison Accelerated Elementary
    School.* (ERIC Document Reproduction Service No. ED 375 502).

McPeck, J. (1990). *Teaching critical thinking.* New York: Routledge.

Muskin, C. (1990). *Constraint of teaching methods and opportunity to learn in
    high school history classes: The pressures of content coverage and
    classroom management.* (ERIC Document Reproduction Service No. ED
    322 038)

Nickerson, R., Perkins, D., & Smith, E. (1985). *The teaching of thinking.*
    Hillsdale, NJ: Lawrence Erlbaum Associates.

Paul, R. (1997a). *Critical thinking: Basic theory & instructional structures.* Wye
    Mills, MD: Foundation for Critical Thinking.

Paul, R. (1997b). Lecture notes from the National Academy: Training for
    trainers. Teaching critical thinking strategies to colleagues. July 27-31,
    1997. Sonoma State University at Rohnert Park, CA.

Paul, R. (1995). *Critical thinking: How to prepare students for a rapidly
    changing world.* Santa Rosa, CA: Foundation for Critical Thinking.

Paul, R., Binker, A., Martin, D., & Adamson, K. (1995). *Critical thinking
    handbook: High school.* Santa Rosa, CA: Foundation for Critical
    Thinking.

Paul, R., Elder, L., & Bartell, T. (1997). *California teacher preparation for*

instruction in critical thinking: Research findings and policy
recommendations. Sacramento, CA: California Commission on Teacher
Credentialing.

Paul, R. & Nosich, G. (1995). A model for the national assessment of higher
order thinking. In R. Paul. *Critical thinking: How to prepare students for
a rapidly changing world* (pp. 103-151). Santa Rosa, CA: Foundation
for Critical Thinking.

Riley, V. (1991). Teachers' questioning for improvement of critical thinking skills.
Dissertation Abstracts International. 53 (03), 0740A. (University
Microfilms No. AAI9135488).

Rooney, P. (1992). *The report of the evaluation of the model technology school
program in the Hueneme School District.* Port Hueneme, CA: Hueneme
School District.

Schifter, D. (1996). A constructivist perspective on teaching and learning
mathematics. In C. Fosnot. (Ed.), *Constructivism: Theory, perspectives,
and practice* (pp. 73-91). New York: Teachers College Press.

Schoenfeld, Alan H. (1982). Some thoughts on problem-solving research and
mathematics education. In K. Lester & J. Garofalo (Eds.), Mathematical
problem solving: Issues in research. Philadelphia, PA: Franklin Institute.

Schon, D. (1983). *The reflective practitioner.* New York: Basic Books.

Schrag, F. (1992). Critical thinking. In M. Alkin (Ed.), *Encyclopedia of
educational research.* New York: Macmillan.

Sizer, T. (1992). *Horace's school: Redesigning the American high school.*
Boston: Houghton Mifflin.

Tsai, M. (1996). Secondary school teachers' perspectives of teaching critical
thinking in social studies classes in the Republic of China. *Dissertation
Abstracts International, 57* (02), 0569A. (University Microfilms No.
AAI9619698).

Unrau, N. (1997). *Thoughtful teachers, thoughtful learners.* Scarborough,

Ontario, Canada: Pippin.

Wehmeyer, L. (1995). *The educator's information highway.* Lancaste, PA: Technomic.

Yin, R. (1993). *Applications of case study research.* Newbury Park, CA: Sage.

APPENDIX A
INTERVIEW PROTOCOL
Exemplary High School Practices in Critical Thinking

INTERVIEW PROTOCOL
Exemplary High School Practices in Critical Thinking

Interview Introduction

"My name is_____. I'm calling with regard to a study that's being undertaken on exemplary high school practices in critical thinking. At the outset you should know that: (1) I am tape recording the conversation to use it as data for coding and analysis, (2) your answers will be confidential and your identity anonymous, and (3) the study will not report on individual schools. Thank you for your participation.

You should understand that there are no particular answers I am looking for other than those which give us the benefit of your most accurate and candid views. If you feel that you are in no position to answer any given question (or set of questions) for any reason, I ask that you simply inform me that you lack the requisite information.

When you give your answer to the questions, feel free to elaborate on or illustrate them in any way you want. When I ask follow-up questions, I am seeking to make clear what precisely is being asked in the question, since some of the questions can be interpreted in different ways. Feel free to ask me to clarify any question you don't understand."

Background Information Questions

• Gender?_____

• Years of teaching experience?_____

• Did you enter education from another field?_____What?_____

• What grade level–courses do you teach most regularly?_____

_____

• What would you identify as the subject area in which you are best prepared?

_____

• Have you read any articles or books, or attended any conferences on critical thinking

in the last 5 years you can mention?_____

_____

(1) Would you explain to me your concept of critical thinking? Perhaps you could begin by completing the following sentence: "To me, critical thinking is _____."

Follow-up:

• *Could you elaborate further on your conception?*

• *Could you give me an example of your use of critical thinking outside the classroom that illustrates your concept of it? (e.g., as a consumer, as a parent, as a citizen, or in a personal relationship)*

• *In your answer you've mentioned processes such as analysis, synthesis, evaluation, and application. What intellectual standards would you use to distinguish whether or not these processes re being done critically vs. uncritically?*

• *Does your conception of critical thinking involve any traits of mind?*

• *an example of a trait that some might identify is open-mindedness.* (If you do prime by mentioning this trait and value, and you receive an affirmative answer, ask for an elaboration—*"How do you teach for this trait in the classroom?"*—to determine whether the traits or values mentioned have actually been thought-through or are simply being rhetorically expressed. Remember, you are looking here to determine the extent to which an interviewee has developed a clear, elaborated, and substantive conception of critical thinking.)

(2) Is there anything you do on a daily basis in the classroom that you believe fosters critical thinking?

Follow-up:

• *Do you have any other structures that you find particularly effective in teaching your students to think critically about your subject?*

• *How do you emphasize critical thinking within that structure?*

(3) Some teachers feel they have too much other instructional work to do in order to have much time left for fostering critical thinking. What is your view of this position?

Follow-up:

• *Do you teach or have you taught any courses that require a great deal of instructional work, and if so, how do you foster critical thinking in those courses?*

• *Could you please give me an example from the design of your classes?*

(Remember, here we are seeking to see if the interviewee understands how critical thinking can be used as a tool for deeper understanding of content rather than to see the learning of critical thinking as a distraction from the learning of content. In other words, a reconciliation occurs when a teacher discovers that students truly learn content best when they think that content through critically.)

(4) What particular critical thinking skills do you believe are most important for your students to develop?

If they hesitate for 5-10 seconds, say *"Is the question clear, or do you want some clarification?"*

Follow-up:

• *In your answer you've mentioned processes such as analysis, synthesis, evaluation, and application. What intellectual standards would you use to distinguish whether or not these processes are being done critically vs. uncritically?*

• *Could you give me an example of how you teach critical thinking skills in the classroom?*

• *Could you give me an example of the use of one of those skills in some everyday context, outside of the classroom? (e.g., as a consumer, as a parent, citizen, in a personal relationship)*

(If the interviewee asks what you mean by a particular or specific critical thinking skill, answer *"Well, some would identify the ability to assess information for its relevance to an issue or the ability to clarify an issue or problem as important component critical thinking skills." "In your view which are the most important component critical thinking skills?"* Remember that we are seeking to determine here whether the interviewee has thought through distinguishable component critical thinking skills and can explain what those skills constitute.)

(5) If you had the task of assessing the extent to which some teacher was or was not emphasizing or fostering critical thinking through his or her instruction, how would you go about making that assessment?

Follow-up:

• *Could you elaborate further?*

• *Could you give me an example of how you would go about conducting this assessment?*

• *In your answer you've mentioned processes such as analysis, synthesis, evaluation, and application. What intellectual standards would you use to distinguish whether or not these processes are being done critically vs. uncritically?*

(Prime if necessary by asking, *"For example, would you use classroom visitation? What exactly would you be looking for if you did visit a class?"* If they say, "I would look at their tests and questions," then ask, *"What criteria would you use to evaluate your colleague's tests and test questions?"* If they say, "I would look to see if they're encouraging students to use their own thinking and ideas," then say *"How would you assess the quality of the students' thinking and ideas?"* Remember, you are looking here to determine the extent to which a teacher has developed a clear, elaborated, and substantive conception of how to assess another teacher to determine the extent to which that teacher was or was not fostering critical thinking in his–her students.)

144

(6) What is your personal conception of intellectual criteria or standards?

Is the question clear to you? I can give you further clarification if you want?
Follow-up:
• *What qualities do you look for in your students' reasoning that tell you whether or not they are reasoning well or poorly?" For example, if you emphasize the importance of being accurate in their thinking, then "accuracy" is a general criteria or standard you value.*
• *In your answer you've mentioned processes such as analysis, synthesis, evaluation, and application. What intellectual standards would you use to distinguish whether or not these processes are being done critically vs. un-critically?*
• *If a student said to you, "What criteria should I use in deciding when to accept or reject some editorial or some position that someone defends?" what advice would you give them?*
• *What intellectual standards do you use to evaluate students' reasoning?*
• *Could you name some and elaborate on them?*

(If an interviewee asks what we mean by "intellectual standards," the common answer should be: *"By intellectual standards we mean general criteria that one uses to decide what to accept as true or false, reasonable or unreasonable."* You could also say, *"Well, a concern for accuracy is an intellectual criterion or standard essential to science. That is the sort of thing we have in mind, general intellectual criteria that a thinker might use to assess what people assert or claim."*

Next two questions to be used as a cross-check to assess teacher knowledge of critical thinking concepts.

Read the following to interviewees: *"To conclude the interview I have two final questions to help us assess the extent to which there are agreed-upon uses of some terminology frequently found in articles and books on critical thinking. The terms 'inference,' 'implication,' and 'assumption,' have been selected as a focal point. Please answer these questions based on your use of these terms."*

(7) How would you explain the difference between an assumption and an inference?

(8) How would you explain the difference between an inference and an implication?

(9) On a scale from one to six, how well do you feel you were prepared by your teacher education program to develop critical thinking in your students? One is no preparation. Six is great preparation.

No preparation 1 2 3 4 5 6 Great preparation. (Circle one number.)

Coding Sheet for Open-Ended Questions

Interviewee _____Time _____Date _____

Coder _____ Tape number _____

(1) Concept of Critical Thinking

• Some **vagueness** in answer	0
• Some **misconception** in answer	0
• **Wanders** from question	0
• **Contradiction** in answer (or in relation to another answer)	0

(a) **Little** or **no** conception
(b) **Limited** conception
(c) **Elaborated** conception

_____

_____

_____

_____

_____

_____

(2) Description of Typical Day in Class That Fosters Critical Thinking

• Some **vagueness** in answer	0
• Some **misconception** in answer	0
• **Wanders** from question	0
• **Contradiction** in answer (or in relation to another answer)	0

(a) **Little** or **no** conception
(b) **Limited** conception
(c) **Elaborated** conception

_____

_____

_____

_____

(3) Reconciling Covering Content with Fostering Critical Thinking

- Some **vagueness** in answer   0
- Some **misconception** in answer   0
- **Wanders** from question   0
- **Contradiction** in answer (or in relation to another answer)   0

(a) **Little** or **no** conception
(b) **Limited** conception
(c) **Elaborated** conception

---

(4) Critical Thinking Skills That Are Most Important for Your Students to Develop

- Some **vagueness** in answer   0
- Some **misconception** in answer   0
- **Wanders** from question   0
- **Contradiction** in answer (or in relation to another answer)   0

(a) **Little** or **no** conception
(b) **Limited** conception
(c) **Elaborated** conception

---

(5) How One Would Assess the Extent To Which a Teacher Was–Was Not fostering Critical Thinking

- Some **vagueness** in answer   0
- Some **misconception** in answer   0
- **Wanders** from question   0
- **Contradiction** in answer (or in relation to another answer)   0

(a) **Little** or **no** conception
(b) **Limited** conception
(c) **Elaborated** conception

(6) Your Personal Conception of Intellectual Standards.

- Some **vagueness** in answer   0
- Some **misconception** in answer   0
- **Wanders** from question   0
- **Contradiction** in answer (or in relation to another answer)   0

(a) **Little** or **no** conception
(b) **Limited** conception
(c) **Elaborated** conception

---

(7) Difference Between Assumption and Inference

- Some **vagueness** in answer   0
- Some **misconception** in answer   0
- **Wanders** from question   0
- **Contradiction** in answer (or in relation to another answer)   0

(a) **Little** or **no** conception
(b) **Limited** conception
(c) **Elaborated** conception

---

(8) Difference Between Inference and Implication

- Some **vagueness** in answer   0
- Some **misconception** in answer   0
- **Wanders** from question   0
- **Contradiction** in answer (or in relation to another answer)   0

(a) **Little** or **no** conception
(b) **Limited** conception
(c) **Elaborated** conception

The interviewee did–did not mention the following:

(1) **Basic Skills of Thought,** such as clarifying the question; gathering relevant data or information; formulating or reasoning to logical or valid conclusions, interpretations, or solutions; identifying key assumptions, tracing significant implications, entering accurately into alternative viewpoints. One is not mentioned. Six is elaborated.

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

_____

(2) **Important Intellectual Traits of Mind,** such as intellectual humility, intellectual perseverance, intellectual responsibility, intellectual integrity, and fair-mindedness. One is not mentioned. Six is elaborated.

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

_____

(3) Teaching to facilitate **Reasoning Within the Subject,** such as teaching for historical thinking, sociological thinking, mathematical thinking, biological thinking, scientific thinking, philosophical thinking. One is not mentioned. Six is elaborated.

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

_____

(4) **An Emphasis on Problem Solving.** One is not mentioned. Six is elaborated.

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

_____

(5) **The Special Need for Critical Thinking Today** in virtue of such phenomena as accelerating change, intensifying complexity, and increasing interdependence (or analogous phenomena). One is not mentioned. Six is elaborated.

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

_____

(6) **The Need for a Greater Emphasis on Peer and Student Self-Assessment.** One is not mentioned. Six is elaborated.

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

_____

APPENDIX B
OBSERVATION PROTOCOL
Exemplary High School Practices in Critical Thinking

APPENDIX B
OBSERVATION PROTOCOL
Exemplary High School Practices in Critical Thinking

Teacher Observed–School:_____ Date:_____

Time:_____

Use the following rubric of responses for each of the questions #001 - 004
(Adapted from Pathwise by Educational Testing Service, 1995, Domain C,
Criterion C3, p. 31.)

1.0 The teacher discourages students from thinking independently, creatively, or
   critically.

1.5 Above level 1.0, but below level 2.0.

2.0 The teacher encourages students to think independently, creatively, or critically
   in the context of the content being studied.

2.5 Above level 2.0, but below level 3.0.

3.0 The teacher uses activities or strategies that are specifically designed to actively
   encourage students to think independently, creatively, or critically about the
   content being taught.

3.5 Above level 3.0

_____ 001. Does the teacher recognize and use opportunities to help students
   extend their thinking?

_____ 002. Is the teacher able to use the current content appropriately as a
   springboard to independent, creative, or critical thinking?

_____ 003. Does the teacher challenge students' thinking in ways relevant to
   their background knowledge and experiences?

_____ 004. Does the teacher structure specific learning activities that encourage
   students to extend their thinking? (Domain C, Criterion C3, p. 31)

The following questions are adapted from Baron (1987, pp. 226-231)

Yes / No 110. Does the teacher use wide-angle (whole class) as well as telephoto
   lenses to assess whether students are thinking critically?

Yes / No 120. Does the teacher appear to evaluate student thinking continually
   throughout the class?

Yes / No 130. Does the teacher look for sustained efforts at critical thinking?

Yes / No 140. Does the teacher look for transfer to other situations on the part of her students?

Yes / No 150. Does the student look for side effects of her students' thinking?

Yes / No 160. Does the teacher encourage metacognition on the part of her students?

Yes / No 170. Does the teacher use a variety of approaches to assess student thinking?

~~Yes / No~~ 180. What are the students doing during class discussions?

Yes / No 181. Are they asking their own questions?

Yes / No 182. Are they challenging one another?

Yes / No 183. Are they piggybacking on one another's comments?

Yes / No 184. Are they viewing themselves as scholars?

Yes / No 185. Are they asking for justification and clarification?

The following questions are adapted from Costa (1985, p. 220). "Six rather temporal dimensions have been identified in teachers' thinking. Every instructional thought, event, occurrence, or situation can be defined in terms of sequence, simultaneity, synchronicity, duration, rhythm, and temporal logic."

Yes / No 210. Are the instructional events ordered?

Yes / No 220. Are multiple objectives handled at the same time?

Yes / No 230. Does it all come together effectively?

Yes / No 240. Is time allocated effectively to produce critical thinking?

Jackson (1993, p. 46) advocates a two-step process for classroom observations:

We can distinguish two phases of the process: one descriptive, the other reflective. The descriptive phase takes place while sitting in the classroom . . .and consists of jotting down whatever strikes one as noteworthy, without worrying unduly at the time about its potential . . . significance. Later, those notes can be expanded, preferably that same day or soon after, in order to fill in some of the detail that is still remembered but was not jotted down. It is then that the reflective phase begins. The following space is for jotting down noteworthy events during the observation.

The following questions were based on a (1998) interview with Richard Paul.

Basic Skills of Thought
301. Are students encouraged to clarify the question?

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

302. Are students encouraged to gather relevant data?

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

303. Are students encouraged to reason to a valid solution?

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

304. Are there discussions of the assumptions?

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

305. Are the implications of conclusions discussed?

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

306. Have students entered accurately into alternative viewpoints?

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

Important Intellectual Traits of Mind

307. Are students encouraged to discriminate and identify what they don't know as well as what they do know? (Intellectual humility)

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

308. Does the classroom involve intellectually challenging work that requires students to persevere? (Intellectual perseverance)

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

309. Are students expected to achieve a high degree of precision and accuracy in their reasoning? (Intellectual responsibility)

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

310. Do students feel secure and free enough to honestly acknowledge their inconsistencies? (Intellectual integrity)

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

311. Are students encouraged to treat each other alike without reference to their own feelings or interests? (fair-mindedness)

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

Reasoning Within the Subject

312. Is there an atmosphere of thinking within a discipline (e.g., mathematical thinking)?

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

Intellectual Criteria or Standards

313. Were there any references during the classroom observation to universally accepted intellectual standards for critical thinking (e.g., relevancy, accuracy, precision, depth, sufficiency, logic, clarity, consistency)? If so, which? Circle.

Not mentioned 1 2 3 4 5 6 Elaborated. (Circle one number.)

Comment_____

APPENDIX C
SAMPLE DATA

APPENDIX C
SAMPLE DATA

Letters Sent

High School	Random	Purposive	Both	Volunteer	Total
A	20	0	0	0	20
B	17	0	3	0	20
C	14	4	0	0	18
D	11	2	1	1	15
E	7	6	3	0	16
F	12	5	0	0	17
Total	81	17	7	1	106

Positive Responses to the Letter = Interview Data

High School	Random	Purposive	Both	Volunteer	Total
A	4	0	0	0	4
B	7	0	3	0	10
C	4	3	0	0	7
D	7	1	1	1	10
E	2	4	2	0	8
F	1	0	0	0	1
Total	25	8	6	1	40

Note. Only four negative responses were received, all randomly sampled. The others simply did not reply to the letter. The total number, 40, equals the number of interviews that were done. For greater generalizability, however, only the *random* (25) plus the *both* (6) = 31 were considered for statistical analysis.

159

<u>Observation Data</u>

High School	Random	Purposive	Both	Volunteer	Total
A	2	0	0	0	2
B	6	0	3	0	9
C	6	1	1	0	8
D	3	1	0	1	4
E	3	3	2	0	8
F	1	0	0	0	1
Total	21	5	6	1	33

<u>Note.</u> For greater generalizability, only the *random* (21) plus the *both* (6) = 27 were considered for statistical analysis.

<u>Teachers Selected for Follow-up Data Regarding Teacher Preparation</u>

High School	Random	Purposive	Both	Volunteer	Total
A	1	0	0	0	1
B	4	0	0	0	4
C	1	0	0	0	1
D	3	0	0	1	4
E	1	1	0	0	2
F	0	0	0	0	0
Total	10	1	0	1	12

<u>Note.</u> Nine responded to the questionnaire: 8 *random* and 1 *purposive*.

AUTHOR'S NOTE

Acknowledgements

Address for Further Information

Paul Everett Thomas
9206 El Cortez Ave.
Fountain Valley CA 92708