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Patricia Barnes Walker entitled

A Descriptive Study of the Relationship
Of Teaching Level and Subject Area Assignment to
Teachers' Attitudes Toward Critical Thinking

has been approved by her committee as satisfactory
completion of the dissertation requirement for the degree
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A Descriptive Study of the Relationship
of Teaching Level and Subject Area Assignment to
Teachers' Attitudes Toward Critical Thinking

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

by

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ACKNOWLEDGEMENTS

To the members of my Dissertation Committee, Dr. Don Forsyth, Dr. Jim Hodges, Dr. Sandford Snider, Dr. Dick Vacca, and my chairman, Dr. Jim McMillan. Their support and guidance in our collective pursuit of quality made the dissertation experience both meaningful and pleasant.

To Dr. David Bauer for his help in untangling the computer programs that lurk about and prey on beginning researchers and statisticians.

To Dr. Jack Duncan for his unflagging optimism. He was never too busy to talk to me, and always helped me find an answer.

To Dr. Pat Duncan for getting me started. She took me under her wing when I was feeling especially low and got me pointed in the right direction.

To my colleagues in the "first wave" of the Urban Services Ph.D. program for the laughter, the tears, and the sweat at all the right times. Their support has meant a lot to me, and I hope that mine has meant as much to them.

To Mrs. Jane Koontz, Professional Librarian at the Virginia Department of Education, for her indescribable assistance in locating reference material. I am told

that doctoral students everywhere accord librarians the same esteem they reserve for gold and precious stones. If this be so, she is a diamond among gems.

To Dr. Barry Beyer of George Mason University, Mrs. Anne Venturino of Henrico County (VA) Schools, and Dr. Jerry Bracey of the Virginia Department of Education, who served with certain of my committee members as a panel of experts in the preparation of my questionnaire. I am fortunate to have had their help.

To my mother and father, Fran and Herman Dykes, who brought me up to believe that I could.

To my daughters and my best friends, Kim and Kelly Barnes, who wouldn't let Mom quit school.

And to my husband, Kent Walker, for more than I can ever say.

Table of Contents

	Page
List of Tables.....	vi
Abstract.....	viii
INTRODUCTION.....	1
Statement of the Problem.....	6
Significance of the Study.....	7
Delimitations of the Study.....	8
Definition of Terms.....	9
REVIEW OF RELATED LITERATURE.....	11
Definitions of Thinking and Critical Thinking..	12
Tests to Measure Critical Thinking Abilities...	22
Programs to Teach Critical Thinking.....	35
Problems Related to Using and Teaching Critical Thinking.....	46
Literature Related to Theories of Change.....	53
Summary.....	56
METHODOLOGY.....	58
Population of the Study.....	58
Sample of the Population.....	59
Development of the Instrument.....	60
Pilot Testing the Instrument.....	63
Reliability of the Instrument.....	64
Procedures of the Study.....	65
Analysis of Data.....	67
ANALYSIS OF DATA.....	71
Analysis of the Demographic Data.....	72
Analysis of the Research Data.....	81
Analysis of Question 1: The Definition of Critical Thinking.....	81
Analysis of Question 2: Critical Thinking Skills.....	84
Analysis of Questions 3-33: Importance of Critical Thinking.....	91
Analysis of Question 34: Activities to Teach Critical Thinking Skills.....	104
Summary.....	108

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS.....	110
Summary of the Purpose and Procedures of the Study.....	110
Conclusions of the Findings.....	113
Recommendations.....	127
References.....	137
Appendix A	
Interview Guide.....	145
Summary of Activities Leading to Development of Critical Thinking Survey.....	151
Critical Thinking Survey.....	153
Letter to Participating School Principals.....	159
Appendix B	
Table B-1: Subject Area Assignment by Age.....	160
Table B-2: Subject Area Assignment by Sex.....	161
Table B-3: Subject Area Assignment by Ethnic Membership.....	162
Table B-4: Subject Area Assignment by Years of Experience.....	163
Table B-5: Subject Area Assignment by Highest Degree Earned.....	164
Table B-6: Intercorrelations of Questions 3-33.....	165
Vita.....	167

List of Tables

Table	Page
1. Distribution of Survey Participants: Table of Teaching Level by Elementary Assignment.....	74
2. Distribution of Survey Participants: Table of Teaching Level by Subject Area Assignment, Middle and High School.....	74
3. Distribution of Survey Participants: Table of Age by Level.....	76
4. Distribution of Survey Participants: Table of Level by Sex.....	77
5. Distribution of Survey Participants: Table of Level by Ethnic Membership.....	77
6. Distribution of Survey Participants: Table of Level by Years of Experience.....	79
7. Distribution of Survey Participants by Years of Experience in Main Subject Area.....	79
8. Distribution of Survey Participants: Table of Teaching Level by Highest Degree Earned.....	80
9. Distribution of Definition by Teaching Level.....	83
10. Distribution of Definition by Subject Area Assignment.....	85
11. Frequency Distribution of the Identification of Critical Thinking Skills by Level.....	87
12. Frequency Distribution of the Identification of Critical Thinking Skills by Subject Area Assignment.....	89
13. Frequency Distribution of Responses to Questions 3-33.....	94
14. Means and Standard Deviations of Questions 3-33 by Level.....	95
15. Means and Standard Deviations of Questions 3-33 by Assignment.....	99

Table	Page
16. Distribution of Activities to Teach Critical Thinking Skills by Level.....	106
17. Distribution of Activities to Teach Critical Thinking Skills by Subject Area Assignment.....	107

A DESCRIPTIVE STUDY OF THE RELATIONSHIP
OF TEACHING LEVEL AND SUBJECT AREA ASSIGNMENT TO
TEACHERS' ATTITUDES TOWARD CRITICAL THINKING

Patricia Barnes Walker, Ph.D.

Virginia Commonwealth University, 1985

Major Director: James H. McMillan, Ph.D.

ABSTRACT

This study describes teachers' attitudes toward critical thinking: their definitions of critical thinking, the importance of critical thinking in their daily lives, how important it is to them that their students use critical thinking in class, whose responsibility it is to teach critical thinking, and who or what has influenced their attitudes about critical thinking. Each of these aspects of critical thinking was analyzed by teaching level (elementary, middle, or high school) and by subject area assignment (English, social studies, mathematics, science, and "other") to determine if relationships exist between these attributes and attitudes toward critical thinking.

The population sample (n=408) consisted of 106 elementary, 123 middle, and 179 high school teachers from a large school division in central Virginia. These teachers completed a Critical Thinking Survey developed

by this researcher.

Results indicate that teachers define critical thinking and critical thinking skills very broadly. There is a lack of consensus about the definition. This is consistent with the literature in the field. Teachers report a high level of importance of critical thinking in their daily lives. They also report that they believe critical thinking to be of great importance to their students, yet only half of them include assessment of critical thinking in their student evaluation procedures.

Teachers seem to accept the responsibility for teaching critical thinking to students. They seem confident in their ability to teach critical thinking, yet they report that they have not had adequate professional training for the task. College, graduate school, and job responsibilities have had a great impact on their attitudes about critical thinking.

There were no significant differences by level or assignment with regard to definition. With regard to identification of critical thinking skills, differences were significant for ten of the 23 listed skills. There were also differences on ten of 31 items measuring importance of critical thinking, and on three of ten activities for teaching critical thinking skills.

CHAPTER I

INTRODUCTION

More than a decade ago, it was observed that literature on critical thinking led to two impressions: that teaching students to think critically is an objective of most teachers and is valued highly, and that there is not much consensus on what is meant by critical thinking (Henderson, 1972, p. 45). In more recent years, the literature on critical thinking still leads to those impressions. Although educators have been concerned about thinking and "the problem of training thought" for more than half a century (Dewey, 1933), it is only recently that the nation's attention has been focused on this highly praised educational goal. "Probably never before in the history of educational practice has there been a greater push to teach children to think critically," says Sternberg (in press). Sadler and Whimbey (in press) speak of this focusing on the improvement of thinking as "a wind shift in academia that is sending us on a new tack in our approach to learning and teaching."

According to Richard Paul (1985a), "the 'critical thinking' movement is just now beginning to have a palpable effect on the day-to-day life of American schooling" (p. 2). He states that critical thinking is "fundamental to education for a free society" (1984, p. 4). Siegel (1980) defends it as "an educational ideal" (p. 7). Sternberg (1984) asserts that thinking skills are needed by more than the college-bound population (p. 47). Baldwin (1984) notes that teaching critical thinking has been a "fundamental purpose of education since the time of ancient Greece" (p. 79). Scriven (1985) sees critical thinking as "critical for survival" (p. 9) and goes on to state that "training in critical thinking should be the primary task of education (p. 11).

In 1983, several major reports drew the nation's attention to problems with American education and gave added impetus to the movement toward critical thinking. In A Nation at Risk (1983), the National Commission on Excellence in Education listed thirteen educational deficiencies which they called "indicators" of the risk. One of them deals with critical thinking: "Many 17-year-olds do not possess the 'higher order' intellectual skills we should expect of them. Nearly 40

percent cannot draw inferences from written material; only one-fifth can write a persuasive essay; and only one-third can solve a mathematics problem requiring several steps" (p. 9).

The Task Force on Education for Economic Growth (1983), a subcommittee of the Education Commission of the States, suggests that we must upgrade our definition of basic skills to include such critical thinking skills as analysis and application (p. 17). Although the authors of these reports do not use the term critical thinking, the skills they cite are generally accepted as critical thinking skills. Mortimer Adler and the Paideia Group (1983) identify three modes of learning: (1) the acquisition of organized knowledge, (2) the development of intellectual skills, and (3) the enhancement of understanding of basic ideas and values. They suggest three modes of teaching: (1) didactic instruction involving lectures and responses, (2) coaching, exercises, and supervised practice, and (3) "maieutic" or Socratic questioning and active participation (pp. 16-17). Maieutic questioning, according to the American Heritage Dictionary of the English Language, pertains to that aspect of the Socratic method that induces a

pupil or respondent to formulate latent concepts and show their connections with reality through a dialectic or logical sequence of questions, a process that would be considered critical thinking by many of the writers in the field today.

Several such writers provide a review of past and current literature on the subject (Paul, 1985a; Glaser, 1985; Norris, 1985a & b) which would indicate that interest in critical thinking is more than a current fad. The experts seem to agree that training in critical thinking should be a major focus in the schooling of American youth.

Problems, however, arise. This training must be provided by classroom teachers, many of whom have not been trained, themselves, to provide such training. Compounding this is the additional problem of lack of consistency among the definitions of critical thinking. Literature from the 1950's (Pingry, 1951), the 1960's (Ennis, 1963), and the 1970's (Swick & Miller, 1975) points out this lack of consensus and previews the same concern still paramount in much of the literature of the 1980's (Beyer, 1985).

More than three decades ago, Pingry (1951) recommended that further defining be done to the term

"critical thinking" or that it be supplemented by specific behavioral outcomes before attempting to teach or evaluate the process of critical thinking. Thirty-four years later, Beyer has compiled some of those specific behavioral outcomes, which have come to be called "critical thinking skills," from seven different writers from 1954 through 1982 (p. 273). Unfortunately, contributors to the literature seem no closer to consensus on the definition now than they were when Pingry wrote his recommendation.

An additional problem is that many teachers do not have the necessary skills to think critically themselves (Norris, 1985b, p. 40; Hunt & Germain, 1969) or to teach children to think critically (Hunt & Germain; Constantine, 1968). One of the components of the critical thinking process is the willingness to think critically (Siegel, 1980; Glaser, 1985; Dewey, 1933). Recent literature deals extensively with definitions of critical thinking, with lists of critical thinking skills, and with programs for teaching critical thinking, but fails to deal with the attitudes of those persons who must teach critical thinking to students. It was John Dewey, many years ago, who stressed attitudes as a component of thinking:

"Because of the importance of attitudes, ability to train thought is not achieved merely by knowledge of the best forms of thought. Possession of this information is no guarantee for ability to think well. Moreover, there are no set exercises in correct thinking whose repeated performance will cause one to be a good thinker. The information and the exercises are both of value. But no individual realizes their value except as he is personally animated by certain dominant attitudes in his own character" (1933, p. 29).

Statement of the Problem

The literature speaks frequently of the need to train teachers to implement critical thinking skills programs but neglects to address the teachers' attitudes toward such training or toward critical thinking in general based on whatever definition a teacher might follow. This study describes teachers' attitudes toward critical thinking: their definitions of critical thinking, the importance of critical thinking in their daily lives, how important it is to them that their students use critical thinking skills in class, whose responsibility it is to teach critical thinking skills to students, and who or what has

influenced teachers' attitudes about critical thinking.

Significance of the Study

The findings of this study are significant for several reasons:

1. This study contributes to the literature on the following points:

- a. how teachers define critical thinking
- b. the importance of critical thinking in teachers' daily lives
- c. the importance to teachers that their students use critical thinking skills in class
- d. teachers' perceptions of whose responsibility it is to teach critical thinking
- e. who or what has influenced teachers' attitudes about critical thinking.

2. A knowledge of teachers' attitudes about critical thinking will aid in implementing critical thinking skills programs in the public and private schools. Findings suggest the areas of need that must be addressed in staff development programs regarding the teaching of critical thinking.

3. An instrument has been developed which

identifies teachers' attitudes about critical thinking. It can serve as a needs assessment for those who must develop in-service programs to prepare teachers to teach critical thinking skills to students.

Delimitations of the Study

This study is delimited by the following factors:

1. Generalizability of the findings is restricted to teachers in a large school division in central Virginia. Questionnaires (n = 408) were received from teachers in five elementary schools (n = 106), two middle schools (n = 123), and two high schools (n = 179). The large size of the sample and the selection of the sample schools on the basis of balanced demographic data minimize this delimitation and contribute to the external validity of the results.

2. Data reported as a description of teachers' attitudes are restricted to teachers' responses to questions on the Critical Thinking Survey.

3. Research variables are restricted to teaching level of respondents (elementary, middle, or high school) and teaching assignment of respondents (elementary school grade level teacher, elementary school "other" teacher, middle school English teacher,

middle school social studies teacher, middle school mathematics teacher, middle school science teacher, middle school "other" teacher, high school English teacher, high school social studies teacher, high school mathematics teacher, high school science teacher, and high school "other" teacher). The demographic variables of ethnic membership, age, years of experience, highest degree earned, and years of experience in major area are used to describe the population.

Definition of Terms

The following definitions are used in this study:

Critical thinking is the assessing of the authenticity, accuracy, and/or worth of knowledge claims and assertions. It calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that surrounds it and the further conclusions to which it tends.

Critical thinking is a collection of separate skills or operations, each of which involves some degree of analysis and evaluation. The following seem to represent the core of these skills:

1. Distinguishing between verifiable facts and

value claims

2. Determining the reliability of a source
3. Determining the factual accuracy of a statement
4. Distinguishing relevant from irrelevant information, claims, or reasons
5. Detecting bias
6. Identifying unstated assumptions
7. Identifying ambiguous or equivocal claims or assertions
8. Recognizing logical inconsistencies or fallacies in a line of reasoning
9. Distinguishing between warranted and unwarranted claims
10. Determining the strength of a statement or an assertion.

The teaching of critical thinking includes any process or activity planned and directed by any teacher, parent, peer, or other person which is aimed at encouraging, fostering, and/or developing the use of critical thinking by someone else. It can also include any process or activity through which one learns to think critically on his or her own.

CHAPTER II

REVIEW OF RELATED LITERATURE

Although there is much literature in the field of critical thinking, very little has been published regarding teachers' attitudes about critical thinking. This review will provide a background of information about critical thinking which will help to define the problem of attitudes. The critical thinking literature will be reviewed in four sections: (1) definitions of thinking and critical thinking, (2) tests to measure critical thinking abilities, (3) programs to teach critical thinking, and (4) problems related to using and teaching critical thinking.

A fifth section will review the literature related to change. This section is included because of its importance in implementing new programs. If this study is to be significant to staff developers who must design in-service programs to train teachers to teach critical thinking skills, some attention must be given to the theory and practice of adapting to innovation.

Many programs based on sound instructional theory fail to survive in the schools because little or no provision is made to overcome natural resistance to change.

Definitions of Thinking and Critical Thinking

A review of the literature shows that the terms thinking and critical thinking are not synonymous. Yet, at the same time, popular usage in this most recent of critical thinking movements finds them used occasionally interchangeably. This causes, or at least contributes to, a lack of consensus of definition so often cited as one of the major concerns of critical thinking research.

In the September 1984 issue of Educational Leadership, 15 articles were published on the theme "Thinking Skills in the Curriculum." The thinking skills addressed in these articles generally fall into three definitional categories. One category encompasses the cognitive skills identified in Bloom's (1964) Taxonomy, i.e., knowledge, comprehension, application, analysis, synthesis, and evaluation. Eight of these articles (Nickerson, 1984; Sternberg, 1984; Whimbey,

1984; Morante & Ulesky, 1984; Bereiter, 1984; Baldwin, 1984; Zenke & Alexander, 1984; Segal & Chipman, 1984) use all or some of these skills in their stated or implied definitions of thinking or critical thinking.

A second category encompasses the Socratic method of questioning and the dialectic or logical method of reasoning. This category accounts for five articles (Paul, 1984a & b; Lipman, 1984; Goldman, 1984a & b). The third category encompasses creative and lateral thinking and is represented by two articles (deBono, 1984; Perkins, 1984).

The term critical thinking is used by several of the authors in categories one and two, but with much inconsistency. The same inconsistency is found among articles in other recent theme issues of journals (National Forum, Winter 1985; Educational Leadership, November 1984 & May 1985). The definitions which follow represent, for the most part, a blending of the upper three taxonomy objectives, i.e., analysis, synthesis, and evaluation, and dialectical logic of the Socratic method.

Henderson (1972) offers three concepts of critical thinking, one held by laymen who have not thought much about the subject, and two held by educators. To some

laymen, "becoming critical means being picky, fault finding, skeptical of and even rejecting cherished beliefs and customs, or injudicious in employing criticism" (p. 45). This, says Henderson, describes a person who is likely to be unpleasant company.

Educators' concepts of critical thinking, however, are quite different. Some educators see critical thinking as about the same as problem solving (p. 45). To other educators, it is about the same as application of principles of logic (p. 46).

Dewey (1933) offers several meanings of thought, and suggests that one way of thinking is better than the others. He calls it "reflective thinking: the kind of thinking that consists in turning a subject over in the mind and giving it serious and consecutive consideration" (p. 1).

In Ennis's early work (1962), he defines critical thinking as "the correct assessing of statements" (p. 83) and suggests that there are three dimensions of the concept (pp. 84-85). The logical dimension covers judging alleged relationships between meanings of words and statements. The critical dimension covers knowledge of the criteria for judging a statement, except for the logical criteria, which are covered by

the logical dimension. The pragmatic dimension covers the importance of the background purpose when making a judgment and whether the statement is "good enough" for the purpose. In other words, is there enough evidence to satisfy the purpose for which the judgment must be made? Ennis's most recent definition (1985) seems to be broader than "the correct assessing of statements" and appears to have grown out of the concepts of dimension: "Critical thinking is reflective and reasonable thinking that is focused on deciding what to believe or do" (p. 45).

Siegel (1980) sees critical thinking as an embodiment of the ideal of rationality, the relevance of reasons. By his definition, a critical thinker is one who "recognizes the importance, and convicting force, of reasons. When assessing claims, evaluating procedures, or making judgments, the critical thinker sees reasons on which to base his or her assessment, evaluation, or judgment" (p. 8).

Glaser (1985) suggests that critical thinking involves three main elements: "(1) an attitude of being disposed to consider in a thoughtful, perceptive manner the problems and subjects that come within the range of one's experiences; (2) knowledge of the methods of

logical inquiry and reasoning; and (3) skill in applying those methods (p. 25).

Beyer (1985), after examining what critical thinking is and is not, concludes that "(S)pecialists today appear to agree that critical thinking is the assessing of the authenticity, accuracy and/or worth of knowledge claims and arguments" (p. 271). He cites Glaser's 1941 definition (p. 271) which relies heavily on Dewey's words: "(A)ctive, persistent, 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" (Dewey, 1933, p. 9).

Beyer has compiled lists of critical thinking skills from seven researchers or teams of researchers (p. 273). While the lists differ in the number of skills related to critical thinking (as few as five, as many as 12), there is considerable agreement and overlap among the skills themselves. If we are to identify critical thinking as specifically as effective teaching and learning require, says Beyer, we must specify the main attributes of these skills. Every critical thinking skill has a set of procedures, criteria, and rules that make it what it is (p. 275).

Each critical thinking skill has a procedure by which it becomes operational, the steps one must follow in using the skill (p. 275). Unique to each critical thinking skill are the specific criteria or clues that serve as evidence to what it is, e.g., looking for emotionally charged words when searching for bias (p. 276). The rules for using each critical thinking skill provide guidelines about using the operations and searching for clues, as well as what to do when certain clues cannot be found (p. 276). These procedures, criteria, and rules must be learned for each critical thinking skill.

Critical thinking, then, is a collection of discrete skills or operations, each of which combines analysis and evaluation to some degree. Beyer has distilled a list of these skills (p. 272) which seem to be at the core of critical thinking operations:

- * Distinguishing between verifiable facts and value claims.
- * Determining the reliability of a source.
- * Determining the factual accuracy of a statement.
- * Distinguishing relevant from irrelevant information, claims, or reasons.
- * Detecting bias.

- * Identifying unstated assumptions.
- * Identifying ambiguous or equivocal claims or arguments.
- * Recognizing logical inconsistencies or fallacies in a line of reasoning.
- * Distinguishing between warranted or unwarranted claims.
- * Determining the strength of an argument.

Definitions similar to Beyer's are offered by Lipman (1985, p. 18), Thomas (1975, p. 5), and Ashby-Davis (1984, p. 5).

But there are those who hold other views. Beyer's assessment of the specialists' agreement would exclude some of Sternberg's ideas. Sternberg speaks of training intellectual skills (1983), teaching intelligence (1984), and teaching critical thinking (in press). In his in-press article, he seems to equate critical thinking with problem solving, which Beyer quite specifically says is not critical thinking. Sternberg criticizes critical thinking skills programs for their failure to address real issues. He speaks of a "lack of correspondence between what is required for thinking, particularly in adulthood, and what is being taught in programs for developing critical thinking skills" (p.

3). He goes on to list and analyze what he calls "critical mistakes," a series of ten concerns, all of which relate directly to problem solving. This concept corresponds to Henderson's first educator-definition of critical thinking but does not coincide with the definitions of Beyer's specialists.

Other inconsistencies arise in reports by Olson (1984) and Brown (1983) in which lower order cognitive skills are being included with higher order skills in definitions of critical thinking. It seems, then, that among the definitions that combine certain cognitive skills with certain dialectical processes, there is still a decided lack of consensus.

The third category in the literature on thinking encompasses creative thinking. Although creative thinking is recognized as a valid and desirable type of thinking, there is consensus among educators that it differs from critical thinking (Henderson, p. 46). Whereas "critical thinking is carried on by applying accepted principles, creative thinking often is accomplished by deliberately rejecting accepted principles. This is not to imply that one cannot be creative in being critical or should not be critical of what he creates. It serves to point out that the

semantic confusion concerning critical thinking has limits; not every cognitive activity is considered to be critical thinking" (p. 46).

Perkins (1984) defines creative thinking as "thinking patterned in a way that tends to lead to creative results" (p. 18). Thus, the ultimate criterion of creativity is output.

DeBono (1967) has coined the term lateral thinking to indicate a departure from the vertical, linear thinking associated with logic. Lateral thinking is not only concerned with problem solving. It has to do with "new ways of looking at things and new ideas of every sort" (p. 14). Lateral thinking is an alternative term, perhaps a broader term, for creative thinking. DeBono agrees that lateral thinking differs from critical thinking, which he describes as reactive: Critical thinking "lacks the creative, constructive, and design elements necessary for social progress...If you teach people to pick out errors in thinking, they will conclude that if there are no errors, the thinking must be right. But error-free thinking is not necessarily superior thinking" (1984, p. 16). In his opinion, critical thinking is not enough.

DeBono maintains that thinking can be taught

directly as a skill (1984, p. 16) and cites programs in Venezuela, Canada, the United Kingdom, Ireland, Australia, New Zealand, Bulgaria, Malaysia, New Guinea, India, and Israel in which his methods, among others, are being used to do exactly that.

McPeck (1981), on the other hand, refutes deBono's work. He criticizes deBono for failing to establish a precise definition for thinking (pp. 102-103). In speaking of deBono, McPeck says, "It is a pity that he does not see that the wide variety of thinking skills, which defy accurate and singular definition, is also what implies that thinking is not a generalized skill. There are simply too many types of thinking, manifest in diverse skills, to permit us to infer a single generalized ability for their respective achievement" (p. 104).

McPeck asserts that thinking is always thinking about something (p. 3), or thinking about X, and that X can never be "everything in general" (p. 4). In isolation from a particular subject, says McPeck, the phrase "critical thinking" neither refers to nor denotes any particular skill: "Critical thinking always manifests itself in connection with some identifiable activity or subject area, never in isolation" (p. 5).

This section has cited only a few selections from among five decades of literature about thinking in general and critical thinking in particular. Some experts in the field are beginning to converge in their definitions and are often seen quoting one another. This would tend to indicate a growing agreement, perhaps a near-consensus. Because the Beyer definition represents as near a consensus as one is likely to find in the literature, it will be used as the definition against which the findings of this study must be interpreted and evaluated. Even though researchers seem to be approaching consensus, as 1985 draws to an end, a working definition of critical thinking is far from precise.

Tests to Measure

Critical Thinking Abilities

In this section, eight tests of critical thinking will be identified and briefly described. Analysis and criticism of four of these tests will be presented. This section is included in the review of related literature to show that this aspect of the critical thinking field suffers from a lack of consensus as does the definitional aspect. Variations in approach,

opinion, and belief in any and all aspects of the field have direct bearing on attitudes about critical thinking.

The September 1984 issue of Educational Leadership (pp. 72-73) identifies six critical thinking tests. One is the New Jersey Test of Reasoning Skills authored by Virginia Shipman and available from IAPC Test Division, Montclair State College in Upper Montclair, New Jersey. It is an untimed test of 50 items. The kinds of items tested are listed as conversion, standardization, general reasoning, assuming, induction, good reasons, syllogism, contradiction, hypothetical reasoning, causal relationships, etc.

Another is the Whimbey Analytical Skills Inventory authored by Arthur Whimbey and available from Franklin Institute Press in Philadelphia. It is an untimed test of 38 items, some of which are differences and similarities, following directions, solving problems, analogical reasoning, mathematical analogies, sorting, trends/patterns, etc.

The Cornell Critical Thinking Test, Level X was authored by Robert Ennis and Jason Millman and is available from University of Illinois Press in Champaign. It is a 76 item test (including four sample

items) and can be timed or untimed. Its items are classified as hypotheses, deduction, reliability of authorities, assumptions, and relevance. There is also a Level Z, which is considered a separate test. It consists of 56 items in seven sections.

The Cognitive Abilities Test, Form 3 (Level H) was authored by Robert Thorndike, Elizabeth Hagen, and Irving Lorge. It is available from Riverside Publishing Company in Chicago. It is a timed test of 25 items per section. Its three sections are Verbal: similarities, sentence sense, classification, and analogies; Quantitative: relating and seriation; and Nonverbal: classification, synthesis, and analogies.

The Watson-Glaser Critical Thinking Appraisal, Forms A and B, was authored by Goodwin Watson and Edward M. Glaser. It is available from Psychological Corporation in New York. It is a timed or untimed test of 80 items covering inference, assumptions, deduction, interpretation, and evaluation of arguments. Its Forms YM and ZM are perhaps better known than Forms A and B.

The Ross Test of Higher Cognitive Processes by John and Catherine Ross is available from Academic Therapy Publications in Novato, California. It is a timed test of 105 items covering analogies, deduction,

missing premises, abstract relations, sequential synthesis, questioning, relevance, and analysis of attributes.

A seventh test is the Curry Test of Critical Thinking, authored by J. F. Curry for her doctoral dissertation published by Boston University in 1971 (Landis & Michael, 1981). Its five subtests are fact and opinion, false authority, making an assumption, inadequate data, and improper analogy.

And last is the Test of Critical Thinking for Secondary School Students, authored by Hugh B. Wood and M. J. Macy and published by the Oregon Association for Supervision and Curriculum Development. It has six parts and a total of 113 items. Its parts attempt to measure inquiring attitude, interest in science, cause and effect, open-mindedness, drawing conclusions and generalizations, and accuracy in observing, calculating, and reporting.

A study was made of the Watson-Glaser Critical Thinking Appraisal (CTA) as a predictor of performance in a critical thinking course (Wilson & Wagner, 1981). Subjects were 55 students accepted into the accelerated medical school program at the University of Akron in 1977, 1978, and 1979. The 33 men and 22 women

represented a racial composition of 48 whites, four blacks, one Asian American, and two Oriental Americans. Each student's grade point average from a two-part physics course was obtained and served as the criterion measure. This special course was taught by one professor to all the students and was designed to teach critical thinking in physics based on Piagetian principles. The CTA was administered to all students during the summer of 1979. Using the criterion of grade point average, a validity coefficient of .45 ($p < .00007$) for the CTA was obtained. A second predictor, the College Board Scholastic Aptitude Test (SAT) achieved a validity coefficient of .54 ($p < .00002$) against the criterion of grade point average. It was determined that the CTA did not add much to the total prediction of performance and should probably not be used as a substitute for regular entrance examinations for colleges and universities. However, the fact that it did significantly predict standing in a specialized course at the college level lends some credence to its criterion-related validity.

Another study (Michael, 1983), was an evaluation by a panel of psychologists of the reliability and validity of the Cornell Critical Thinking Test, Level

X, and the Watson-Glaser Critical Thinking Appraisal. A questionnaire was sent to 19 psychologists with PhD degrees, all of whom had published at least one article concerning critical thinking. The panel sample consisted of the 12 who responded. The questionnaire asked that each respondent rate the Cornell test manual and the Watson-Glaser test manual on how well they met the reliability and measurement error standards classified as Essential in the Standards for Educational and Psychological Tests published by the American Psychological Association in 1974. Ten Essential standards are listed in the area of reliability and measurement error. Standards classified as Desirable or Very Desirable were not included in the study. Respondents had five alternatives for the degree to which the manuals met each standard: (A) meets the standard completely, (B) meets the standard somewhat, (C) meets the standard minimally, (D) does not meet the standard, and (E) standard is not applicable. It was found that both tests tended to meet the standards between a level judged to be "minimal" or "somewhat." No statistically significant differences occurred between the means of the ratings achieved by the tests. It was recommended that the test authors consider

making revisions necessary to enhance their reliability and validity.

Abo El-Nasser (1980) did a lengthy description, analysis, and evaluation of three measures of critical thinking: the Cornell Critical Thinking Test, Levels X and Y, the Watson-Glaser Critical Thinking Appraisal, Form YM, and the Test of Critical Thinking for Secondary School Students. In his analysis of the Cornell test, he describes the critical thinking aspects which are measured by each form, and he examines each form item by item to search for any incorrect answers in the answer keys. He offers as proof of correctness or incorrectness only his own judgment. He does not document his position with the support of others. He acts, as it were, as his own panel of experts. It is his judgment that one item on the Cornell test, Level X, is incorrect (p. 80) and that two items on Level Z are incorrect (p. 88).

In his analysis of the Watson-Glaser test, he identifies no fewer than eight ambiguous or incorrect answers (pp. 97-105). For this test, however, he cites another reviewer who has arrived at conclusions similar to his own. He quotes from Norman A. Broadhurst's article in the April 1970 issue of Science Education in

which Broadhurst indicates that the Watson-Glaser test is not as valid a measure of critical thinking ability as one may desire (Abo El-Nasser, p. 108).

In his analysis of the Test of Critical Thinking for Secondary School Students, Abo El-Nasser identifies a weakness in the scoring of the first and second sections which are intended to measure scientific attitudes and interest in science, respectively. In both cases, two points are awarded to each "C" answer, the choice which indicates high interest in the situation or item described in the question. "Since every student can easily deduce that choosing C will allow him to achieve the highest possible score," says Abo El-Nasser, "one may invoke criticism that the two parts do not effectively measure scientific attitudes and interests" (p. 116).

He also criticizes part four which attempts to measure open-mindedness and intellectual honesty. The authors ask the respondent to indicate "true" or "false" beside each stated fact. In several cases, it is not fact but opinion which is stated. An opinion can not be answered with a true or false, but with an "agree" or "disagree" (p. 117). His main criticism of the test is that it concentrates on psychological

characteristics necessary to critical thinking rather than on the critical thinking skills themselves:

"Instead of considering what an individual does when he thinks critically, most parts of this test...

concentrate on measuring the prerequisite conditions for critical thinking" (p. 119).

McPeck (1981) argues that neither the Cornell test nor the Watson-Glaser test measures critical thinking in any reasonable sense. He has two main criticisms: that "neither the tasks nor the results of these tests show any significant difference from those involved in 'general intelligence' (that is, IQ) testing" and that "the restrictive format of the test precludes the use of critical thinking in any defensible use of that term" (p. 126).

In his analysis of the Watson-Glaser test, McPeck speaks of "numerous muddles and confusions" within the test itself. Watson and Glaser have confused the distinction between propositions, which may be judged true or false, with inferences, which may be judged valid or invalid. They compound the problem by introducing the idea of degrees of truth and falsity (pp. 132-133). McPeck finds the notion of truth and falsity as having degrees to be odd, if not incoherent

(p. 133). He cites the test manual's description of an inference:

"Inference. (Twenty items) samples ability to discriminate among degrees of truth or falsity of inferences drawn from given data" (p. 133).

An additional problem is that some of the test questions require the test taker to bring to bear knowledge or information that is outside the information provided in the test question, and some other questions are self-contained and can be answered using only the information given. These two types of questions require entirely different thought processes. Using examples from the test, McPeck goes on to demonstrate that the questions are not what the authors claim in the directions, and that a student would do poorly if he or she followed the directions (p. 134).

McPeck also questions the validity and statistical reliability of the test. He cites the normative data the authors offer in support of validity and reliability. There are high correlation coefficients between IQ and the Watson-Glaser test results (.55 to .75 with a median of .68) and between reading comprehension and the Watson-Glaser (.60 to .66 with a median of .64). McPeck maintains that these

correlations make a strong case that the test is measuring not so much critical thinking as IQ and/or reading ability (p. 142).

The Watson-Glaser data show that the higher the reading ability, the higher the critical thinking scores. A more crucial test, suggests McPeck, would be to show that there are people with high reading scores who do not score well on the critical thinking appraisal, and that this is not due to chance. Perhaps then there would be reason to believe that something other than reading comprehension is being measured by the test. When Watson and Glaser compared the appraisal scores with a test that does not require reading comprehension, the California Test of Mental Maturity Non-Language Test, they got one of their lowest correlations, .43 (p. 144). McPeck concludes that the available evidence suggests that the variance on Watson-Glaser scores is accounted for by reading comprehension. He can find no statistical evidence that suggests that "an independent or unique set of skills, called critical thinking, is being measured" (p. 144).

McPeck finds the Cornell tests (Level X and Level Z) superior to the Watson-Glaser in that the directions are clear and straightforward, and the tasks involved

are a direct manifestation of the instructions (p. 144). The major shortcoming is that "the format of a standardized multiple-choice test does not permit the comprehensive or circumspect judgements (sic) that are required by the concept of critical thinking" (p. 145). The short questions, with their even shorter answers, prohibit the use of co-author Ennis's dimensional criteria, particularly the "pragmatic dimension," which Ennis says is fundamental to the "correct assessing of statements." This, says McPeck, makes the content of the questions indistinguishable from what may be found on any beginning-logic test. He suggests that the tests might be more correctly titled "The Cornell Informal Logic Tests" (p. 145).

Although some of the sections are judged to be free of ambiguity with precise, correct answers among the choices, in some others which require judgments more characteristic of critical thinking, the items become problematic in that there could be more than one correct answer. For example, the Cornell test, Level X, has twenty-three items on inductive reasoning for which equally strong arguments can be made for answers not listed as "correct" in the test manual (pp. 145-146).

McPeck suggests that the concept of testing has

been oversimplified. He finds that "the notions of literacy and reading comprehension are too complex to be reduced to a few decoding skills. Similarly, critical thinking defies this type of reductionism with the same dire consequences. Both areas of research proceed from the same false premise: that their respective processes are simple collections of more or less mechanical skills" (p. 149).

He believes it is possible to test for critical thinking in a number of ways, and suggests that any such test should meet the following conditions:

1. That the test be subject-specific in an area (or areas) of the test taker's experience or preparation.
2. That the answer format permit more than one justifiable answer. An essay might be more appropriate even though it may be awkward and time-consuming.
3. That good answers are not predicated on being right, in the sense of true, but on the quality of the justification given for a response.
4. That the results should not be used as a measure of one's capacity or innate ability, but as a learning accomplishment--which is usually the result of specific training or experience (p. 149).

Programs to Teach

Critical Thinking

Numerous programs have been developed to teach thinking skills in the classroom. Again, there is a lack of consensus with regard to definition: some programs profess to teach "thinking" while others profess to teach "critical thinking." Nickerson (1984) has reviewed many of the programs currently available and has categorized them by the approach they take to the teaching of thinking. In this section of the literature review, descriptions and analyses of these programs, taken from several sources, will be integrated into Nickerson's suggested categories.

Nickerson has found that these various programs differ from one another on many dimensions (p. 29):

Scope.

Specific skills addressed.

Ages and academic abilities of participating students.

Amount and distribution of class time devoted to the program.

Amount and type of program material (instructions to teachers, student exercises, workbooks).

Latitude given to teachers.

Completeness and availability of documentation.

Degree of integration with other courses.

Amount of emphasis on evaluation.

Evaluation instruments used.

Evidence of effectiveness.

Nickerson and his colleagues find it convenient to group programs to teach thinking into five categories: (1) cognitive-process approaches, (2) heuristics-oriented approaches, (3) approaches that focus on the development of formal thinking in the Piagetian sense, (4) approaches that emphasize language and symbol manipulation, and (5) approaches that focus on thinking as subject matter (p. 29). He acknowledges that this classification is somewhat arbitrary and that several programs could fit into several categories, but that it can help to make some useful distinctions. Not all of these programs are specifically for teaching critical thinking, as defined by Beyer. Some are designed to foster such activities as problem solving, decision making, and creative thinking.

Cognitive process approaches assume that thinking ability depends on certain fundamental processes such as comparing, ordering, classifying, inferring, and

predicting (p. 29). Instructional strategies in these programs involve using the basic cognitive processes in a variety of contexts on the assumption that extensive practice with such tasks will strengthen the processes and make them more readily accessible for application to other contexts as the need arises.

One such program is SOI (Structure of the Intellect based on Guilford) developed by Mary Meeker (Educational Leadership, September 1984, p. 30). Its stated goal is to equip students with the necessary intellectual skills to learn subject matter and critical thinking. It is based on three assumptions: (1) Intelligence consists of 120 thinking abilities which are a combination of operations (comprehending, remembering, and analyzing), contents (words, forms, and symbols), and products (single units, groups, and relationships); (2) Twenty-six of these factors are especially relevant to success in school; and (3) Individual differences in these factors can be assessed with the SOI-Language Arts tests and improved with specifically designed SOI materials. Its intended audience is all students and adults.

In this program, students use materials, some of which are three dimensional, which are prescribed for

them based on a diagnostic test. Computer software is available that gives analyses and prescriptions. The recommended time varies, but can be 30-minute lessons twice a week until abilities are developed as measured on post-assessment.

Another cognitive approach program is Reuven Feuerstein's Instrumental Enrichment (Educational Leadership, September 1984, p. 41). Its goal is to develop the ability to become an autonomous learner. Sample skills include classification/comparison, orientation in space, recognizing relationships, following directions, planning, organizing, logical reasoning, inductive and deductive reasoning, and synthesizing.

Intended for upper elementary, middle, and high school levels, this program is based on three assumptions: (1) Intelligence is dynamic (modifiable), not static; (2) Cognitive development requires direct intervention over time to build the mental processes for learning to learn; and (3) Cognitive development requires mediated learning experiences.

Students do paper and pencil instruments which are introduced by teachers and followed by discussions for insight to bring about transfer of learning. The

teacher becomes the mediating agent. The cognitive tasks in the instructional materials are not subject specific but parallel the subject matter being taught by the teacher. Recommended time is two to three hours a week over a two to three-year period.

Nickerson's second category is the heuristics-oriented approach. As the word is used in the literature on problem solving, heuristic is roughly synonymous with strategy. A heuristic is an approach to a goal that is believed to have a good chance, but not certainty, of success (p. 30). This approach would apply to those problems that cannot use a detailed step-by-step prescription that is certain to succeed.

Nickerson states that educational researchers looking at problem solving are interested in two questions relating to expertise: (1) Does the performance of experts as a group differ from that of novices, and (2) Does the performance of experts in different domains have certain characteristics in common? If experts approach problems differently from the novices, then perhaps the novices' performance could be improved by teaching them to approach problems as the experts do. It has been found that experts spend more time than novices do in such preliminary

activities as conceptualizing a problem, finding alternative ways of representing it, and planning an approach. Understandably, then, programs that are heuristically oriented put considerable emphasis on conceptualizing, representation, and planning activities (pp. 30, 32).

One example of a heuristics-oriented program is Edward deBono's CoRT (Cognitive Research Trust). Its goal is to teach thinking skills useful to everyone in and out of school. Intended for persons of all ability levels, ages eight to 22, it is based on three assumptions: (1) Lateral thinking, unlike vertical thinking, is not necessarily sequential, is unpredictable, and is not constrained by convention; (2) It is not necessary to be right at every stage of the thought process nor to have everything rigidly defined; and (3) Intelligent thinkers are not necessarily skillful thinkers.

Its recommended time is one lesson of 35 minutes or longer each week for three years. In these lessons, students practice "operations" following "lesson notes." Teachers present and monitor the exercises. Evaluation results suggest that the program leads students to take a broader view of formally posed

problems (Educational Leadership, September 1984, p. 17).

Nickerson's third category encompasses approaches that focus on the development of formal thinking in the Piagetian sense. Piaget's work suggests that cognitive development occurs in stages and that the ability to perform formal or abstract operations is acquired only after the ability to perform concrete operations. Many high school graduates go on to college without the ability to perform the abstract or formal tasks that will be required of them (p. 32). They are stuck at the concrete operations level of cognitive development.

To overcome this problem, several programs have been developed to move such students into the formal operations stage. One such program is the Cognitive Levels Matching Project developed by elementary and secondary teachers in the Shoreham-Wading River school district in New York (Brooks, 1984). It is based on the assumption that cognitive development can be facilitated by appropriate educational intervention. The intervention requires teachers to assess the cognitive demands of the curriculum and the cognitive abilities of students, and match the two (p. 23). The CLM project views thinking as a whole that transcends

the sum of its parts; as a process, not a product (p. 25).

The "one-truth" point of view, that there is an identifiable body of knowledge and that the function of the school is to teach children these conventionally accepted truths, has been discarded. This program takes into account the "child's point of view" (p. 24) in which the level of the child's cognitive functioning determines whether his answer is or is not acceptable. A child's answer that would be incorrect based on an adult's cognitive understanding might be correct, or at least reasonable, based on the child's more limited development.

The CLM project has neither a prepackaged, fixed curriculum nor specific curriculum materials. A strong focus of the program is the thoughtful structuring of questions. Teachers are encouraged to ask open-ended and elaborative questions, and to value students' responses as pathways to understanding their points of view (p. 25).

Approaches in Nickerson's fourth category emphasize language and symbol manipulation. Whatever else thinking is, much of it involves symbol manipulation of one type or another. This includes the

writing of prose and the representation of ideas and relationships with nonverbal symbols such as equations and computer programs. Because effective writing requires planning and working toward a goal, breaking tasks into component subtasks, and integrating partial products into a coherent whole, some researchers have felt that it is unlikely that one's language skills, writing in particular, can be improved without a corresponding improvement in one's thinking ability. Conversely, some have suggested that improving one's writing ability should enhance thinking skills as well (pp. 32-33).

One program in this category is the UCI Writing Project developed at the University of California at Irvine by 27 teachers and consultants (Olson, 1984). The program is based on the assumption that writing is a learning tool for heightening and refining thinking: helping students become better thinkers would help them to become better writers and vice versa (pp. 31-32). The project developed a Thinking/Writing model, a sequence of demonstration lessons, K-College, that provide students with practice in thinking and writing. Based on an adaptation of Bloom's Taxonomy, the model has seven stages: (1) Prewriting, in which ideas are

generated; (2) Precomposing, in which ideas are organized and thoughts articulated; (3) Writing, in which thought is transformed into print; (4) Sharing, in which students give and receive feedback on work in progress; (5) Revising, in which ideas are rethought, reshaped, and rewritten; (6) Editing, in which errors in grammar and syntax are corrected; and (7) Evaluation, in which the final product is assessed. The model is designed for all grade levels, K-College, and is implemented within the regular language arts composition classes.

Nickerson's final category encompasses approaches that focus on thinking as subject matter. The assumption in this case is that learning about thinking can improve thinking (p. 34). Closely related to the teaching of thinking as subject matter, says Nickerson, is the recent interest among researchers in metacognition and metacognitive skills. Metacognition is cognition about cognition, knowledge about knowledge, thinking about thinking (p. 34).

One program that explicitly encourages students to think about thinking is the Philosophy for Children program authored primarily by Matthew Lipman and developed at Montclair State College in New Jersey

(Educational Leadership, September 1984, p. 53). Its stated goal is to improve children's reasoning abilities by having them think about thinking as they discuss concepts of importance to them. Sample skills include drawing inferences, making analogies, forming hypotheses, and classifying.

Intended for children K-12, it is based on two assumptions: (1) Children are by nature interested in philosophical issues such as truth, fairness, and personal identity, and (2) Children should learn to think for themselves, to explore alternatives to their own points of view, to consider evidence, to make careful distinctions, and to become aware of the objectives of the educational process. In the program, students read special novels with inquisitive children as characters, followed by teacher-led discussion, using structured discussion plans, exercises, and games. Recommended time is three 40-minute periods per week.

Nickerson reports that there is not much evidence regarding the effectiveness of specific programs for teaching thinking, whether it be thinking in general or critical thinking in particular. The evaluation data that do exist are neither sufficiently extensive nor

sufficiently robust to conclude that any one program is either much better or much poorer than the others. Quantitative data on a few programs indicate that they produce modest improvements in performance on a variety of tests of mental ability (p. 36).

Problems Related to Using and Teaching Critical Thinking

This section will discuss three important premises which are discussed in the literature but not thoroughly explored: (1) Some teachers have not developed their own critical thinking skills, (2) The development of these skills is influenced, among other things, by personal attitudes, and (3) There is a lack of consensus about how to teach critical thinking, or if, in fact, it can be taught at all.

Lack of skills. In addition to discussing both the necessity and the inadequacy of critical thinking skills in children, the literature also suggests that "most high school and college students do not perform extremely well on the kinds of tasks that are used to indicate critical thinking competence, and there is evidence to suggest that adults fare no better" (Norris, 1985, p. 40). Several studies conducted on the

quality of adult thinking, particularly the inferential ability of adults, indicate that adults show systematic tendencies to err on some of the simplest judgments of everyday affairs (Nisbett & Ross, 1980).

Schools are beginning to focus heavily on thinking skills for students, but are giving little attention to the impact of these skills on teachers. Some teachers did not receive thinking skills training in their own schooling, and are, therefore, unprepared to foster these skills in their students. They sometimes "fail to apply systematic thinking to their own daily instructional tasks" (Martin, 1984, p. 68).

A study by Hunt and Germain (1969) examined the critical thinking abilities of teachers and their relationship to the teachers' classroom verbal behavior and perceptions of teaching purposes. Thirty-nine teachers from six schools (three elementary, two junior high, and one high school) volunteered to take the Watson-Glaser Critical Thinking Appraisal. The ten teachers with the highest scores and the ten teachers with the lowest scores were used as the sample group. The two groups differed significantly from each other: The high scorers fell into the upper quartile when compared to college senior women, and the low scorers

fell into the lower quartile. There were no significant differences in age, sex, grades taught, years of teaching experience, and years of college attendance.

Each of the 20 teachers was observed for three one-half hour periods at different times during the teaching day in order to cover a variety of content material. The observations were tape-recorded, and the teachers' verbal comments were transcribed and then classified in two ways by four judges. First, comments were classified according to the thought processes evidenced (cognitive memory, convergent thinking, evaluative thinking, or divergent thinking). Second, they were classified by impact on students (supportive, non-supportive, or neutral).

There were greater frequencies of verbalizations from both teachers and students in the high scoring teacher group than in the low scoring teacher group. The high scoring teachers also made more verbal comments in the areas of convergent, evaluative, and divergent thinking than did the low scorers, and they made a higher number of supportive comments to students. Teachers who were judged as having low critical thinking abilities used fewer verbal interactions with students, used fewer higher level

thinking processes, and made fewer supportive statements to students.

Paul (1984a) suggests that teachers should take at least one university level course in critical thinking: "Teachers need to begin to do some critical thinking about critical thinking programs, to gain a grasp of what makes sense to them and what they can begin immediately to do...Unlike the case of computer skills or other technical skills, there is a natural disinclination for people to recognize the degree to which they themselves have not developed critical thinking skills...To the extent that people lack critical thinking skills, they conceptualize those who have them as prejudiced, close-minded, overly academic, negative or nit-picky" (p. 6).

Attitudes. One of the components of the critical thinking process is the willingness to think critically. Siegel (1980) calls this the "critical spirit" or "critical attitude." A critical spirit "habitually seeks evidence and reasons, and is predisposed to so seek" (p. 9). Glaser (1985) tells us there is evidence to suggest "that an individual's personality traits and attitudes affect his or her ability to think" (p. 27).

Dewey (1933) states, "If we were compelled to make a choice between those personal attitudes (open-mindedness, wholehearted interest, responsibility in facing consequences) and knowledge about the principles of logical reasoning...we should decide for the former" (p. 34).

Research in sociology, anthropology, and psychology has shown that our thoughts, actions, and perceptions often reflect in-group and ethnocentric commitments and biases. Research into social perception reveals that individuals unconsciously operate with implicit theories about people that bias their judgments (Paul 1985c, p. 46). These perceptions may either encourage or inhibit an attitude disposed to critical thinking.

The literature also speaks of individual differences among children and the child's point of view (Sternberg, 1984; Brooks, 1984; Grennon, 1984; Edwards & Marland, 1984) but neglects to consider individual differences in teachers and the fact that a teacher's point of view, just as child's might also differ from the "right" answer or the "right" approach. Differences in point of view might also encourage or inhibit critical thinking attitudes.

Teachability. Articles about all types of thinking skills programs in schools typically report that only small groups of teachers initiate or participate in such programs (Falkof & Moss, 1984, p. 4) or that the teachers who do participate in them are volunteers (Dillon, 1984, p. 54). Even school-wide programs do not always have 100% participation of teachers (Brooks, 1984, p. 27).

Still a controversy is whether or not critical thinking should be taught in separate courses or integrated into the subject area curricula. According to Lipman (1984), some subject area teachers do not feel it is their responsibility to teach critical thinking skills. Lipman concurs. He says thinking skills should be taught in philosophy courses starting in elementary school, and not in the separate disciplines: "The teachers in these areas contend, and quite rightly, that they cannot take time out from the teaching of their disciplines to teach the skills necessary to think in those disciplines. Such skills should have been acquired by the students earlier; one cannot wait until a discipline is taught for the students to acquire the skills necessary to learn it" (p. 56).

Joyce (1985) disagrees. He states that "strategies for thinking do not come in fragments. We can't teach their elements as isolated skills...Thinking strategies are most effectively taught in conjunction with appropriate content" (p. 7). This parallels McPeck's (1981) idea that critical thinking is not a generalized skill, but that it is always connected with some identifiable activity or subject area (p. 5).

McPeck says that critical thinking is teachable, and that it involves both "a propensity and a skill" (p. 17). Thus, teaching someone to be a critical thinker involves both his cognitive and affective domains in an area of study.

Perhaps Paul's (1985a) comments on the historical expectations of teaching in general will illustrate teacher' reluctance and/or inability to teach for critical thinking: "In the early days, the teacher was any adult who had no other job and could read, write, and cipher...Eventually, education came to be considered as a 'science' of methods of 'delivery.' At no point along the way, even to this day, have prospective teachers been expected to demonstrate their ability to lead a discussion Socratically (see Adler's The Paideia Proposal). Teachers are not expected to

force students to explore questions about the consistency of their beliefs, to examine the evidence that can be advanced for or against their beliefs, to note the assumptions upon which these beliefs are based, or to trace the implications of these beliefs. They are not usually expected to think analytically or critically about the issues of the day" (p. 32).

For various reasons, as expounded by the experts, critical thinking is a complex process, and must necessarily be a complex process to teach. In speaking of the necessity to teach beyond minimum competency, Bracey (1983) suggests that many skills are being taught, not because they are essential, but because they are easy to teach, and that other skills are being neglected because they are harder to teach. In his words, "Children are being overinstructed in a few teachable skills..." (p. 718). Critical thinking skills seem to be among those that are hard to teach.

Literature Related to

Theories of Change

In the fields of sociology and social psychology, there is much literature regarding social and educational change. A few sources are cited here to

provide a framework of change theory and diffusion of innovations on which to ground conceptualizations about the teaching of critical thinking skills.

Implementation of a thinking skills program is likely to be seen by teachers as an innovation, something they have not been required to do before. Problems surrounding implementation become meaningful as they relate to the larger picture of social change as well as to the smaller picture of personal abilities and individual differences.

Moorish (1976) points out that "(C)hanges and innovations affect people and their attitudes, not simply institutions and their methods, and in any attempt to understand innovation in education we shall inevitably find ourselves analysing human personality and interpersonal relationships" (pp. 21-22). He suggests a working definition of innovation: an improvement which is measurable, the result of deliberate choice and development, durable and unlikely to occur frequently, and likely to be closely related to the development of social technology in a substantial rather than superficial way (pp. 23-24).

Fullan (1982) deals with the "meaning" of educational change: "The problem of meaning is central

to making sense of educational change...Neglect of the phenomenology of change--that is, how people actually experience change as distinct from how it might have been intended--is at the heart of the spectacular lack of success of most social reforms" (p. 4).

While the Moorish and Fullan references deal primarily with educational change, Rogers (1971) speaks more globally: "innovativeness indicates behavioral change, the ultimate goal of modernization programs, rather than cognitive or attitudinal change" (p. 176). Rogers emphasizes the need to standardize the descriptions of categories of change-adopters since there are numerous such categories. Rogers offers five adopter categories--innovators, early adopters, early majority, late majority, and laggards--and calls them ideal types. They are based on abstractions from empirical cases and are intended as a guide for theoretical formulations and empirical investigations.

Rogers' adopter categories point out the differences among people as they tend toward or away from adoption of innovations. For some people, it is not necessary to have the support or sanction of friends and colleagues. These are the innovators, and they are defined by Rogers as venturesome, rash, and

daring. The opinion leader is represented by the early adopter; he is a respected member of the community whose help is often sought by change agents who wish to use his influence for change and whose advice is often sought or whose example is often followed by would-be adopters of innovations who wish to determine what they should do. Persons in the early majority are careful deliberators; they appear to need the sanction of opinion leaders, adopting with deliberate willingness, but seldom leading. Persons in the late majority apparently are not concerned with peer sanction. In fact, due to their skepticism, they require peer pressure to adopt an innovation. The laggards require no sanction from anyone but traditional thinkers like themselves. By the time some laggards have adopted an innovation, some innovators and early adopters have already gone on to another one.

Summary

This chapter reviewed the literature with regard to definitions of critical thinking and found a lack of consensus among writers in the field. It then looked at tests for measuring critical thinking abilities and found criticisms and reports of inadequacy from test

reviewers. Programs for teaching critical thinking fell into several categories and differed greatly in their approaches and purposes. Problems with using and teaching critical thinking revolve around teachers' lack of skills, uncertain or missing attitudes, and the inconsistency of teaching practices. Research about change indicates that the population is varied in its ready adoption of innovation.

Several decades of literature review had led to the same observations. In the mid 1980's we still seem to be far from precision or even simple agreement about what critical thinking is, how it should be taught, who should teach it, how it can be tested, and how programs to foster it can be successfully implemented.

CHAPTER III

METHODOLOGY

This is a survey research study which describes teachers' attitudes about critical thinking: their definitions of critical thinking, the importance of critical thinking in their daily lives, how important it is to them that their students use critical thinking skills in class, whose responsibility it is to teach critical thinking skills to students, and who or what has influenced teachers' attitudes about critical thinking. Data have been gathered through a questionnaire developed as a part of the study.

Population of the Study

The population consists of elementary, middle, and high school teachers from a large public school division in central Virginia. This division was chosen as the study site for two reasons: (1) It employs a sufficiently large number of teachers from which a sample could be drawn, and (2) it encompasses urban,

suburban, and rural areas within its boundaries. The division operates seven high schools, six middle schools, 32 elementary schools, one special education school, and three vocational schools.

Sample of the Population

Nine of the school division's 49 schools were chosen to participate in the study. Five were elementary schools, two were middle schools, and two were high schools. A total of 408 teachers completed the survey and are included in the data analysis: 106 elementary school teachers, 123 middle school teachers, and 179 high school teachers.

This researcher worked closely with the school division's director of research to establish criteria for the selection. An attempt was made to represent all geographic areas and socioeconomic levels in the county. Demographic information was studied prior to selection to insure that the sample schools were representative of schools in the division. The final selection of schools was made by the director of research for the school division.

One high school, one middle school, and two elementary schools are located in a geographical area

known as the west end. This is a suburban area with a relatively high socioeconomic level. One middle school and one elementary school are located in an area known as northside. This area is a mixture of urban and suburban influences with a predominantly middle socioeconomic level but with high and low levels represented as well. One high school and two elementary schools are located in an area known as the east end. The high school and one of the elementary schools are surrounded by both suburban and rural influences, while the other elementary school is in an almost totally rural environment with the exception of a few fairly new suburban neighborhoods. These schools also represent a cross section of socioeconomic levels with the middle level predominating.

Development of the Instrument

A questionnaire entitled Critical Thinking Survey was developed by this researcher and used as the data gathering instrument for the study. This questionnaire went through several stages of development.

Interview Guide. An interview guide (Appendix A) was developed by this researcher based on a review of the literature. It asked seven demographic questions

which could be answered in single words or phrases and 20 substantive questions which must be answered in more detail.

Panel of Experts. This guide was submitted for review and criticism regarding content validity to Drs. James McMillan and James Hodges of Virginia Commonwealth University and Dr. Gerald Bracey of the Virginia Department of Education. Based on their suggestions, the guide was revised.

Interviews. This researcher conducted interviews with four elementary school teachers, three middle school teachers, and four high school teachers, a total of 11. Interviewees were contacted by their building administrators and asked if they would participate in this phase of the study. During the interview, they were told that their answers to the interview questions and their suggestions regarding wording, structure, and order in which questions should be asked would be used to develop a survey instrument which would gather data for the study.

Interview Summary. Following the interviews, each interviewee was sent a summary of the interview and asked to respond if he or she disagreed with this researcher's interpretation of answers given and

comments made during the interview session.

Development of Survey. The results of these interviews (Appendix A) led to the development of the Critical Thinking Survey (Appendix A), hereafter called the Survey. Questions were written as multiple choice items offering not only a range of responses, but also a space in which the subject could write his or her own response if those presented did not describe his or her attitude/feeling/thinking.

Panel of Experts. This instrument was submitted to a panel of experts for comment regarding content validity and clarity of wording. The panel consisted of Drs. James McMillan, James Hodges, and Donelson Forsyth of Virginia Commonwealth University, Dr. Barry Beyer of George Mason University, Mrs. Anne Venturino of Henrico County Schools, and Dr. Gerald Bracey of the Virginia Department of Education.

Revision of Survey. Based on suggestions from the panel of experts, many questions were reworded for clarity. Also, based on the experts' suggestions, a second format was developed. This presented statements, most of which were selected from the multiple choices of the original form. The respondent was asked to indicate the strength of his agreement or disagreement

with these statements on a five-point Likert scale.

Pilot Testing the Instrument

The Survey was pilot tested with six elementary school teachers, five middle school teachers, and nine high school teachers, a total of 20. Each pilot test respondent was asked to complete both forms of the Survey and indicate which form he or she preferred. Respondents were told they would be asked to participate in a second testing in approximately ten days, after revisions were made following the first testing.

The alternate format, with the Likert scale, was chosen as the final form of the Survey because its range of responses offered greater precision of measurement, thus avoiding a violation of the assumptions of the statistical analysis procedures. Several wording changes were made for increased clarity and precision of meaning. Ten days after the first testing, participants received the final form of the survey which they completed at their convenience during the next three days and returned to this researcher. One participant was disqualified after the second testing because she had given the same response to

every question, even those which contradicted each other.

Reliability of the Instrument

Since only continuous data can be used in correlations, some questions on the Survey are not included in the report of reliability. Of the 31 questions that provide such data, only 28 were present on both the first and second forms of the pilot test.

A first-test summary score and a second-test summary score were determined for each of the remaining 19 pilot test participants on the 28 questions. A response of "strongly agree" or "agree" was counted as agreement and assigned a score of +1. A response of "have neutral feelings" was assigned a score of 0. And a response of "disagree" or "strongly disagree" was counted as disagreement and assigned a score of -1. A summary score was obtained by totalling the scores assigned to the separate questions. This was done for both the first and second tests. A Pearson Product-Moment test-retest reliability correlation of .87 was achieved.

Procedures of the Study

McMillan and Schumacher (1984) identify seven steps in conducting survey research:

1. Define purpose and objectives.
2. Select resources and target population.
3. Choose and develop techniques for gathering data.
4. Sampling.
5. Letter of transmittal.
6. Follow-up.
7. Nonrespondents (pp. 161-165).

The purpose of the study is defined in Chapter I. The target population is defined in an earlier section of this chapter. The proximity of the population to the researcher's home community lessened the potential impact of modest resources. The data gathering instrument and the steps in its development are described earlier in this chapter. The sampling procedure is also described in this chapter: participating schools were not chosen at random but were selected on the basis of balanced demographic data. Since the instruments were hand delivered and picked up, items five and six do not apply. If item seven applies, it does so in only the most minor way.

The principals of the selected schools administered the instruments at faculty meetings. It is assumed that all teachers present participated. If there were nonrespondents, there were certainly very few.

Permission was obtained from the school division to conduct the study with its teachers. The school division's director of research contacted the principal of each selected school and secured his or her agreement to participate. This researcher prepared a letter of explanation and instructions to be read by the principal or the principal's designee to the teachers at the beginning of the test administration (Appendix A). This researcher then delivered copies of the letter and sufficient copies of the Survey to each participating school on the day prior to the return of the teachers for the 1985-86 school session. This researcher reviewed the purpose and the instructions and answered any questions raised by the principals. As a psychological incentive and a token of appreciation, this researcher attached a small candy bar to each Survey form.

In eight of the schools, the Survey was administered at faculty meetings during the pre-school week. In the ninth school, it was administered at an

afternoon faculty meeting during the first week of school. It was reported that 20 minutes was sufficient time for the completion of the Survey. Principals of the schools collected the completed Surveys and held them until this researcher returned to the schools to pick them up.

Analysis of Data

This researcher described teachers' attitudes about critical thinking based on participating teachers' responses to 34 survey questions, some of which allowed more than one answer. These responses were analyzed by the independent variables of teaching level and assignment.

The independent variables are as follows:

Teaching level -- elementary
 middle
 high, and

Assignment

middle and high -- English/language arts
 social studies
 mathematics
 science
 other

Two analysis of variance procedures, General Linear Models, were also used to determine a relationship between the independent variables of teaching level, i.e., elementary, middle, and high, and the dependent variables and to determine a relationship between subject area assignment and the independent variables.

There are two questions which ask respondents to "choose all that apply" from among a list of choices. These responses are reported with frequency distributions by level and assignment and are further analyzed with chi-square procedures.

Six additional independent variables are identified in the demographic data:

1. Ethnic membership
2. Sex
3. Year of birth (age)
4. Years of experience
5. Highest degree earned
6. Years of experience in major area.

These variables are reported descriptively as well as in frequency tables to describe the sample. They are not used in the statistical analyses of the dependent variables. It is likely that whatever demographic

variables that might account for differences in attitudes among teachers have already manifested themselves in the teachers' choices of teaching level and subject area assignment, or are not measurable by this researcher.

CHAPTER IV

ANALYSIS OF DATA

The Critical Thinking Survey includes five types of items: (1) eight items soliciting demographic information, (2) one item to determine the respondent's definition of critical thinking, (3) one item asking the respondents to identify critical thinking skills, (4) 31 items dealing with the importance of critical thinking, and (5) one item asking respondents to identify activities they use to teach critical thinking.

This chapter analyzes each section in turn. First, demographic characteristics of the sample are described. Second, the relationship between two teacher attributes (teaching level and subject area assignment) and teachers' attitudes toward critical thinking is examined. The nature of the analysis for each section is described under the appropriate section heading.

Analysis of the Demographic Data

The eight demographic variables are teaching level, subject area assignment, age, sex, ethnic membership, years of teaching experience, years of experience in main subject area, and highest degree earned. Frequency distribution tables show level by assignment for elementary teachers and level by subject area assignment for middle and high school teachers. Frequency distribution tables also show age, sex, ethnic membership, experience, and degree by teaching level. Tables showing the distribution of demographic variables by subject area assignment are included in Appendix B.

Teaching level and assignment. Table 1, which shows the distribution of level by elementary assignment, indicates that most of the respondents (81.6%) were regular classroom teachers. The grade level designation refers to classroom teachers who teach in self-contained or departmentalized classrooms at a particular grade level on a regular basis. The designation "other" refers to a teacher who has a professional responsibility in an elementary school in a capacity other than that described in the grade level classification. This includes resource teachers,

special subjects teachers, librarians, counselors, and the like. Elementary teachers are analyzed by assignment on this table only. Because many of them teach in self-contained classrooms, they are not included in the subject area assignment analyses reported in subsequent sections of this chapter.

Table 2 shows the distribution of teaching level by subject area assignment for middle and high school teachers. The subject areas of English, social studies, mathematics, and science are analyzed individually. All other subjects and all other areas of professional responsibility are analyzed under the category "other." The academic subject areas of English, social studies, mathematics, and science account for more than half (55%) of the middle and high school teachers.

Age. The survey asked for year of birth; 108 participants chose not to respond. Birth dates were translated to ages according to ten-year categories which correspond to the twenties (ages 20-29), the thirties (30-39), the forties (40-49), the fifties (50-59), and the sixties (60 plus). There were no respondents in their seventies.

Table 1

Distribution of Survey Participants
Table of Teaching Level by Elementary Assignment

Level	Assignment			
	No response	Grade level	Other	Total
Elementary	3	84	19	103
Frequency Percent	-	81.55	18.45	100

Table 2

Distribution of Survey Participants
Table of Teaching Level by Subject Area Assignment:
Middle and High School

Level	Assignment						
	No resp.	Engl.	Soc. Stud.	Math	Sci.	Other	Total
Middle	0	24	9	17	19	54	123
Frequency Percent	-	19.51	7.32	13.82	15.45	43.90	100
High	2	33	24	21	18	81	177
Frequency Percent	-	18.64	13.56	11.86	10.17	45.76	100
Total	2	57	33	38	37	135	300
Frequency Percent	-	19.00	11.00	12.67	12.33	45.00	100

Table 3 shows the age distribution by teaching level. About 40% of the respondents at all levels are in their thirties, and about 30% are in their forties. Only 30% of the respondents fall into all other categories combined. It is interesting to note that only eight teachers, one at the elementary level, three at the middle level, and four at the high school level, responded to the 60 plus category.

Sex. Table 4 shows the distribution of sex by teaching level. In round figures, these data appear to indicate that, for this sample, only one out of 20 elementary teachers is a man, one out of eight middle school teachers is a man, and one out of four high school teachers is a man.

Ethnicity. Table 5 shows the ethnic distribution of survey participants by teaching level. The teaching staffs of all three levels are predominantly white. In round numbers, one out of every eight teachers is black. At the elementary level, the proportion is similar to that of the total: one out of eight. At the middle school level, only one out of 20 is black, and at the high school level, one out of six is black. Only one other ethnic group is represented: one high school teacher is Asian.

Table 3
 Distribution of Survey Participants
 Table of Age by Level

Age	Level			
	Elem.	Middle	High	Total
No response	33 -	32 -	43 -	108 -
20-29	9 12.33	13 14.29	22 16.18	44 14.67
30-39	29 39.73	38 41.76	55 40.44	122 40.67
40-49	24 32.88	24 26.37	40 29.41	88 29.83
50-59	10 13.70	13 14.29	15 11.03	38 12.67
60 plus	1 1.37	3 3.30	4 2.94	8 2.67
Total	73 24.33	91 30.33	136 45.33	300 100.00

Table 4

Distribution of Survey Participants
Table of Level by Sex

Level	Sex				
	Frequency Percent	No resp.	Male	Female	Total
Elementary	10		4	92	96
	-		4.17	95.83	100
Middle	1		15	107	122
	-		12.30	87.70	100
High	3		69	107	176
	-		39.20	60.80	100
Total	14		88	306	394
	-		22.33	77.67	100

Table 5

Distribution of Survey Participants
Table of Level by Ethnic Membership

Level	Ethnic Group					
	Frequency Percent	No resp.	White	Black	Asian	Total
Elementary	24		71	11	0	82
	-		86.59	13.41	0.00	100
Middle	10		107	6	0	113
	-		94.69	5.31	0.00	100
High	21		131	26	1	158
	-		82.91	16.46	0.63	100
Total	55		309	43	1	353
	-		87.54	12.18	0.28	100

Years of experience. Table 6 shows years of experience distributed by teaching level. The experience categories shown in the table do not represent equal numbers of years. The 0-3 category represents those teachers who are still probationary and have not yet been granted a continuing contract. The 4-10 category represents those teachers who have passed the probationary period and who may or may not be planning to make teaching a career. The 11-20 category represents the career teachers, and the 21 plus category represents longevity in the teaching field. At all three levels, the 11-20 category shows the highest percentage.

Table 7 shows the distribution of survey participants by years of experience in their main subject area. On the survey, this question was separate from the question regarding total years of experience. It appeared to be confusing to participants; many of them wrote in the name of the subject area rather than the years spent. This made the non-response rate more than five times that of the years of experience question. Because of the discrepancy in the non-response rate, further analysis of this variable was not attempted.

Table 6

Distribution of Survey Participants
Table of Level by Years of Experience

Level	Years of Experience					Total
	Frequency Percent	No resp.	0-3	4-10	11-20	
Elementary	0	8	31	44	23	106
	-	7.55	29.25	41.50	21.70	100
Middle	4	11	37	53	18	119
	-	9.24	31.09	44.54	15.13	100
High	3	12	64	72	28	176
	-	6.82	36.36	40.91	15.91	100
Total	7	31	132	169	69	401
	-	7.73	32.92	42.14	17.21	100

Table 7

Distribution of Survey Participants
by Years of Experience in Main Subject Area

Years Exp/ Main Area	Frequency	Cumulative Frequency	Percent	Cumulative Percent
No resp.	38	-	-	-
0-3	48	48	12.973	12.973
4-10	142	190	38.378	51.351
11-20	132	322	35.676	87.027
21 plus	48	370	12.973	100.000

Highest degree earned. Table 8 shows the distribution of highest degree earned by teaching level. At the elementary level, a little over one-fourth of the teachers have earned Master's degrees, while at the middle and high school levels, more than 40% have earned the graduate degree.

Summary. The population sample is predominantly white (88%) and predominantly female (78%). Over 40% of the teachers are in their thirties, over 42% have been teaching from 11 to 20 years, and almost 40% have earned a graduate degree.

Table 8

Distribution of Survey Participants
Table of Teaching Level by Highest Degree Earned

Level	Degree					Total	
	Frequency	Percent	No resp.	Assoc.	Bachelor		Master
Elem.	1		0	77	28	0	105
	-		0.00	73.33	26.67	0.00	100
Middle	1		1	65	55	1	122
	-		0.82	53.28	45.08	0.82	100
High	3		0	99	77	0	176
	-		0.00	56.25	43.75	0.00	100
Total	5		1	241	160	1	403
	-		0.25	59.80	39.70	0.25	100

* Two Master's degrees

Analysis of the Research Data

The rest of the data are analyzed with respect to the purpose of the study. Five aspects of teachers' attitudes about critical thinking were investigated. The first aspect, the definition of critical thinking, is addressed in survey questions one and two. The second aspect, the importance of critical thinking in teachers' daily lives, is addressed in survey questions three, four, and five. The third aspect, the importance of student use of critical thinking, is addressed in questions six through twelve and question 28. The fourth aspect, responsibility for teaching critical thinking, is addressed in questions 13 through 25 and question 34. And the final aspect, who or what has influenced teachers' attitudes about critical thinking, is addressed in questions 26 and 27 and questions 29 through 33.

Analysis of Question 1:

The Definition of Critical Thinking

Question 1 represents the first of four sections of the Critical Thinking Survey. It asks respondents to choose among three possible definitions of critical thinking or to provide a definition of their own.

As noted earlier, experts do not agree on the definition of critical thinking. Question one seeks to discover if that same lack of consensus exists among elementary, middle, and high school level practitioners. It also seeks to describe what teachers' beliefs are about what critical thinking is.

A one-sample chi-square test was used to determine whether the frequency of choice of definition was significant or whether it could be due to chance. The obtained value $\chi^2 = 133.2$, $df = 2$, $p < .001$) indicates that the majority choice of definition B, the definition endorsed by Beyer's "specialists," is significant.

Table 9 shows the number of elementary, middle, and high school teachers who chose each definition. At all levels, more than half of the respondents chose definition B. Only 15 participants gave definitions other than those offered, and most of them suggested a combination of definitions A and B. A chi-square analysis showed no differences among teaching levels with respect to definition ($\chi^2 = 6.19$, $df = 8$, $p < .6262$).

Table 9
Distribution of Definition by Teaching Level

Level	Definition						
	Frequency	No resp.	A	B	C	D	Total
Elem.	1		31	56	14	4	105
	-		29.52	53.33	13.33	3.82	100
Middle	1		24	77	16	5	122
	-		19.67	63.11	13.12	4.10	100
High	1		50	100	22	6	178
	-		28.09	56.18	12.36	3.37	100
Total	3		105	233	52	15	405
	-		25.92	57.54	12.84	3.70	100

Notes: Definitions

- A. the higher cognitive skills identified in Bloom's Taxonomy: application, analysis, synthesis, evaluation.
- B. a persistent effort to examine any belief or statement in light of the evidence that surrounds it to assess its authenticity, accuracy, and/or worth.
- C. a refusal to settle for the one right answer, an attempt to consider alternatives that do not present themselves in formal, logical thinking.
- D. My definition is different from these. This is my definition:

Table 10 shows the distribution of definition by subject area assignment. More than half the respondents in all subject areas except science (with just under half of the respondents) chose definition B. A chi-square analysis showed no differences among subject area assignments with respect to definition of critical thinking ($\chi^2 = 21.87$, $df = 16$, $p < .1476$).

Analysis of Question 2:

Critical Thinking Skills

Question 2 presents a list of 23 learning skills and three blank lines for others. Participants were asked to check all that they consider to be critical thinking skills. This question was included in that portion of the instructions that asks for their first reactions. After they read the definition provided on the next page of the questionnaire, they were asked not to return to this question.

Table 11 shows the frequency distribution of the identification of critical thinking skills by teaching level. The most chosen skill overall was "problem solving" (94.2%), followed by "decision making" (91.1%) and "distinguishing between fact and opinion" (90.6%). Least chosen were "memorizing" (14.1%) and "sounding

Table 10

Distribution of Definition by Subject Area Assignment

Assignment	Definition						
	Frequency Percent	No resp.	A	B	C	D	Total
English	0	19	30	4	4	57	
	-	33.33	52.63	7.02	7.02	100	
Soc. St.	0	8	21	4	0	33	
	-	24.24	63.64	12.12	0.00	100	
Math	1	11	21	4	1	37	
	-	29.73	56.76	10.81	2.70	100	
Science	1	9	18	6	3	36	
	-	25.00	50.00	16.67	8.33	100	
Other	0	27	86	20	2	135	
	-	20.00	63.70	14.82	1.48	100	
Total	2	74	176	38	10	298	
	-	24.83	59.06	12.75	3.36	100	

Notes: Definitions

- A. the higher cognitive skills identified in Bloom's Taxonomy: application, analysis, synthesis, evaluation.
- B. a persistent effort to examine any belief or statement in light of the evidence that surrounds it to assess its authenticity, accuracy, and/or worth.
- C. a refusal to settle for the one right answer, an attempt to consider alternatives that do not present themselves in formal, logical thinking.
- D. My definition is different from these. This is my definition:

out words" (18.7%). All other skills were chosen by at least 60% of the participants.

Chi-square analyses ($df = 2$) show significant differences among eight of the 23 skills by teaching level. More than 70% of middle and high school teachers identified "listening" as a critical thinking skill, compared to 60% of elementary teachers.

For the other seven skill choices shown to be significant, elementary and/or middle school teachers chose the skills more often than did high school teachers. An example is "sounding out words." Although only 18.7% of the teachers identified this as a critical thinking skill, it seems that elementary and middle school teachers were not as strong in their repudiation of it as were high school teachers. Only 12% of high school teachers identified it as a critical thinking skill, as compared to a little over 20% of the elementary and middle school teachers.

"Detecting bias" is another. Almost 87% of middle school teachers and slightly over 80% of elementary teachers chose this one. About 75% of the high school teachers identified this as a critical thinking skill.

Table 11

Frequency Distribution of the Identification of Critical Thinking Skills
by Level

Skill	Level			Chi-Sq	Prob
	Elem. n=106	Middle n=123	High n=179		
Reading	61 57.55	88 72.13	112 62.92	5.511	.0636
Listening	64 60.38	92 75.41	128 71.91		
Decision making	101 95.28	107 87.70	161 90.45	4.006	.1349
Problem solving	100 94.34	118 96.72	163 91.57		
Sounding out words	22 20.75	28 22.95	22 12.36	6.463	.0395
Distinguishing between fact and opinion	93 87.74	113 92.62	163 91.57		
Detecting bias	85 80.19	106 86.89	133 74.72	6.661	.0358
Identifying main idea	71 66.98	84 68.85	125 70.22		
Identifying supporting details	71 66.98	76 62.30	99 55.62	3.805	.1492
Determining the strength of a statement or an assertion	90 84.91	82 67.21	116 65.17		
Detecting inconsistencies and fallacies	90 84.91	108 88.52	147 82.58	2.001	.3677
Predicting outcomes	92 86.79	85 69.67	110 61.80		
Comparing and contrasting	94 88.68	105 86.07	148 83.15	1.688	.4300
Brainstorming	78 73.58	80 65.57	78 43.82		
Identifying unstated opinions	71 66.98	68 55.74	104 58.43	3.252	.1967
Determining reliability of a source	73 68.87	99 81.15	115 64.61		
Distinguishing between relevant and irrelevant information	97 91.51	111 90.98	152 85.39	3.403	.1824
Looking for alternatives	87 82.08	88 72.13	113 63.48		
Identifying ambiguous or equivocal claims or assertions	82 77.36	91 74.59	120 67.42	3.779	.1511
Memorizing	18 16.98	15 12.30	23 12.92		
Hypothesizing	82 77.36	88 72.13	116 65.17	4.980	.0829
Identifying a problem	82 77.36	92 75.41	133 74.72		
Stating conclusions	75 70.75	84 68.85	114 64.04	1.563	.4576

"Brainstorming" was also chosen by more elementary (74%) and middle school teachers (66%) than by high school teachers (44%).

"Determining the reliability of a source" was chosen mostly by middle school teachers (81%). Elementary and high school teachers were at 68% and 65% respectively.

Several skills were chosen mostly by elementary teachers. Among them is "looking for alternatives." Elementary teachers identified this as a critical thinking skill by 82%, middle school teachers by 72%, and high school teachers by 63%.

Another is "determining the strength of a statement or an assertion." Almost 85% of the elementary teachers identified this as a critical thinking skill, as compared to only 67% of middle school teachers and 65% of high school teachers.

"Predicting outcomes" was also chosen heavily by elementary teachers (87%). It was chosen by 70% of middle school teachers and 62% of high school teachers.

Table 12 shows the distribution of the identification of critical thinking skills by subject area assignment ($df = 4$). When elementary teachers are removed from the analyses, the order of choice changes.

Table 12

Frequency Distribution of the Identification of Critical Thinking Skills
by Subject Area Assignment

Skill	Assignment					Chi-Sq	Prob
	English n=57	Soc St n=33	Math n=38	Science n=37	Other n=133		
Reading	37 64.91	24 72.73	29 76.32	22 59.46	86 64.66	3.304	.5083
Listening	38 66.67	24 72.73	32 84.21	23 62.16	101 75.94	6.392	.1717
Decision making	52 91.23	29 87.88	36 94.74	29 78.38	120 90.23	6.185	.1857
Problem solving	53 92.98	30 90.91	37 97.37	36 97.30	123 92.49	2.467	.6506
Sounding out words	13 22.81	3 9.09	7 18.42	6 16.22	19 14.29	3.573	.4669
Distinguishing between fact and opinion	53 92.98	31 93.94	36 94.74	31 83.78	123 92.48	4.040	.4007
Detecting bias	54 94.74	29 87.88	29 76.32	27 72.97	98 73.68	13.520	.0090
Identifying main idea	43 75.44	21 63.64	29 76.32	23 62.16	91 68.42	3.327	.5047
Identifying supporting details	36 63.16	19 57.58	25 65.79	21 56.76	72 54.14	2.411	.6607
Determining strength of statement/assertion	43 75.44	24 72.73	21 55.26	23 62.16	85 63.91	5.358	.2525
Detecting inconsistencies and fallacies	51 89.47	32 96.97	35 92.11	32 86.49	103 77.44	12.058	.0169
Predicting outcomes	44 77.19	23 69.70	23 60.53	27 72.97	76 57.14	8.987	.0614
Comparing and contrasting	46 80.70	28 84.85	33 86.84	31 83.78	113 84.96	0.798	.9387
Brainstorming	24 42.11	17 51.52	22 57.89	19 51.35	74 55.64	3.467	.4829
Identifying unstated opinions	45 78.95	22 66.67	22 57.89	20 54.05	61 45.86	19.337	.0007
Determining reliability of a source	47 82.46	24 72.73	26 68.42	26 70.27	89 66.92	4.901	.2976
Disting. between relevant/ irrelev. information	53 92.98	30 90.91	34 89.47	30 81.08	114 85.71	3.854	.4261
Looking for alternatives	36 63.16	23 69.70	27 71.05	26 70.27	87 65.41	1.091	.8956
Ident. ambiguous/equivocal claims/assertions	49 85.96	23 69.70	27 71.05	29 78.38	81 60.90	13.450	.0093
Memorizing	5 8.77	4 12.12	7 18.42	7 18.92	13 9.77	4.321	.3643
Hypothesizing	41 71.93	23 69.70	26 68.42	24 64.86	88 66.17	0.815	.9364
Identifying a problem	57 75.44	27 81.82	30 78.95	30 81.08	93 69.92	3.676	.4517
Stating conclusions	39 68.42	23 69.70	27 71.05	24 64.86	83 62.41	1.557	.8165

"Problem solving" remains first choice, while "distinguishing between fact and opinion" moves up from third to second place. "Detecting inconsistencies and fallacies" moves into third place, up from sixth, and "decision making" moves to fourth, down from second.

Chi-square analyses show four skills to be significant by assignment. Only one of these, "detecting bias," is also significant by level. English and social studies teachers show the highest percentage of identification at 95% and 88% respectively. All other subjects range between 73% and 76%.

Also significant is "detecting inconsistencies and fallacies." Social studies and math teachers chose this one most often, with 97% and 92% respectively. English and science teachers were next with 89% and 87% respectively. "Other" teachers chose it least often, with 77%.

Almost 86% of English teachers chose "identifying ambiguous or equivocal claims or assertions" as a critical thinking skill, while 78% of science teachers, 71% of math teachers, and almost 70% of social studies teachers did so. It was chosen by only 61% of "other" teachers.

The final item of significance is "identifying unstated opinions." Again, it is the English teachers who lead, at 79%. Social studies teachers are next, at 67%. This skill was chosen by 58% of the math teachers, 54% of the science teachers, and 46% of the "other" teachers.

This question and question one (definition of critical thinking) were answered from each participant's individual point of view. Respondents were told in the instructions that their answers to questions 1 and 2 should reflect their first reactions. After they had gone beyond these two questions, they were asked not to return to them. In order to have a common base from which to analyze the rest of the data, answers to all subsequent questions were to be based on a definition of critical thinking provided on the next page of the survey form.

Analysis of Questions 3-33:

Importance of Critical Thinking

There were 31 questions in this section of the Critical Thinking Survey. The questions were written as statements with which the participant indicated agreement or disagreement on a 5-point Likert scale.

Participants could strongly agree (SA), agree (A), have neutral feelings (N), disagree (D), or strongly disagree (SD). In the numerical analysis, strong agreement is given a value of 1, and strong disagreement a value of 5.

Table 13 summarizes the frequency of responses for these questions. There were 14 questions which had the agreement or strong agreement of at least 70% of the respondents (questions 3, 10, 12, 14, 15, 17, 18, 19, 20, 21, 22, 23, 30, and 31) and four questions which had the disagreement or strong disagreement of at least 70% (4, 5, 7, and 9). One question (29) had a balance of agreement/strong agreement (35%), neutral feelings (33%), and disagreement/strong disagreement (31%).

This section was analyzed with a general linear models procedure. This is an analysis of variance procedure that is used when the data contain uneven numbers of observations in the categories being compared. As a rule, data are not analyzed more than once with the same statistical procedure. In this study, however, these data are analyzed once for differences among teaching levels and again for differences among subject area assignments. It is necessary to do two separate analyses because

elementary teachers in this school division are not typically assigned to subject areas. They must, therefore, be excluded from a subject area analysis by teaching level.

A post hoc procedure, the Duncan Multiple Range Test, was used to test all the differences between means. A post hoc test also adjusts the level of significance to reduce the influence of chance when using more than one comparison. In order for differences in means to attain significance on a post hoc test, those differences have to be rather substantial (Kerlinger, 1973, p. 235). The Duncan test indicates groupings of means according to their similarities and differences. It should be remembered that the higher the mean, the greater the disagreement with the statement in the question. For some of the questions, the General Linear Models procedure shows statistical differences which do not appear in the Duncan analyses.

Table 14 shows the means and standard deviations of questions 3-33 by teaching level. Four questions were found to have statistical significance at the .05 level and two at the .01 level.

Table 13

Frequency Distribution of Responses to Questions 3-33

Question	Response					Total
	SA	A	N	D	SD	
3	159 39.16	205 50.49	28 6.90	13 3.20	1 .24	406 100.0
4	9 2.22	18 4.43	16 3.94	128 31.53	235 57.88	406 100.0
5	9 2.23	19 4.71	7 1.74	113 28.04	255 63.27	403 100.0
6	86 21.24	188 46.42	88 21.73	39 9.63	4 .99	405 100.0
7	10 2.48	58 14.36	34 8.42	175 43.31	127 31.43	404 100.0
8	11 2.74	105 26.12	81 20.15	146 36.31	59 14.68	402 100.0
9	7 1.73	7 1.73	11 2.71	102 25.18	278 68.64	405 100.0
10	213 52.21	154 37.74	21 5.15	17 4.17	3 .73	408 100.0
11	122 30.20	150 37.13	71 17.57	43 10.64	18 4.45	404 100.0
12	179 44.20	189 44.67	26 6.42	10 2.47	1 .25	405 100.0
13	68 13.71	193 47.42	76 18.67	63 15.48	7 1.72	407 100.0
14	155 37.99	208 50.98	33 8.09	10 2.45	2 .49	408 100.0
15	207 51.24	174 43.07	14 3.46	7 1.73	2 .49	404 100.0
16	5 1.24	24 5.94	99 24.50	192 47.52	84 20.79	404 100.0
17	71 17.84	245 61.56	65 16.33	16 4.02	1 .25	398 100.0
18	75 18.99	254 64.30	51 12.91	14 3.54	1 .25	395 100.0
19	67 17.09	246 62.75	64 16.38	14 3.57	1 .25	392 100.0
20	81 20.66	253 64.54	49 12.50	8 2.04	1 .25	392 100.0
21	61 15.64	227 58.20	83 21.28	15 3.85	4 1.03	390 100.0
22	62 15.81	230 58.67	77 19.64	21 5.36	2 .51	392 100.0
23	59 15.13	218 55.90	97 24.87	15 3.85	1 .25	390 100.0
24	14 3.55	84 21.32	103 26.14	153 38.83	40 10.15	394 100.0
25	26 6.48	154 38.40	160 39.90	53 13.22	8 1.99	401 100.0
26	15 3.79	76 19.91	105 26.51	129 32.58	71 17.93	396 100.0
27	27 6.78	165 41.46	175 43.97	29 7.29	2 .50	398 100.0
28	31 7.81	183 46.10	108 27.20	69 17.38	6 1.51	397 100.0
29	25 6.23	117 29.17	133 33.17	95 23.69	31 7.73	401 100.0
30	78 19.45	208 51.87	65 16.21	38 9.48	12 2.99	401 100.0
31	94 23.44	225 56.11	61 15.21	16 3.99	5 1.25	401 100.0
32	33 8.25	156 39.00	39 9.75	127 31.75	45 11.25	400 100.0
33	19 4.74	72 17.95	101 25.19	164 40.90	45 11.22	401 100.0

Table 14

Means and Standard Deviations of Questions 3-33 by Level¹

Quest.	<u>Elementary</u>		<u>Middle</u>		<u>High</u>		F value	Prob
	Mean	STD	Mean	STD	Mean	STD		
3	1.792	.881	1.664	.638	1.771	.725	1.09	.3367
4	4.236	1.100	4.402	.951	4.436	.835	1.70	.1842
5	4.385	1.017	4.553	.842	4.401	.955	1.34	.2626
6	2.356	.985	2.163	.853	2.197	.933	1.62	.1989
7	3.686	1.129	4.041	.970	3.860	1.124	3.17	.0429
8	3.173	1.019	3.483	1.152	3.343	1.100	2.51	.0829
9	4.566	.840	4.598	.746	4.559	.775	.14	.8695
10	1.443	.587	1.772	.965	1.654	.816	5.37	.0050
11	2.077	1.147	2.312	1.037	2.242	1.161	1.47	.2303
12	1.689	.773	1.689	.751	1.667	.680	.05	.9538
13	2.391	.966	2.342	1.062	2.402	.963	.20	.8180
14	1.764	.670	1.667	.697	1.832	.804	1.90	.1509
15	1.596	.718	1.492	.606	1.612	.730	1.22	.2949
16	4.000	.737	3.675	.864	3.785	.941	3.65	.0268
17	2.050	.642	2.016	.760	2.125	.738	.95	.3888
18	2.010	.577	1.975	.780	2.052	.699	.39	.6785
19	2.040	.618	2.050	.743	2.105	.726	.24	.7902
20	2.000	.592	1.909	.719	1.988	.656	.74	.4762
21	2.323	.801	2.017	.741	2.179	.753	4.38	.0132
22	2.255	.722	2.033	.785	2.197	.775	2.56	.0785
23	2.306	.709	2.107	.794	2.164	.709	2.22	.1096
24	3.317	1.029	3.107	1.003	3.444	1.030	3.94	.0203
25	2.835	.864	2.570	.874	2.616	.839	3.78	.0236
26	3.490	1.041	3.353	1.075	3.419	1.159	.60	.5479
27	2.670	.719	2.471	.754	2.494	.758	2.48	.0850
28	2.745	.941	2.562	.893	2.512	.911	2.38	.0939
29	3.068	1.012	2.967	.995	2.926	1.096	.61	.5463
30	2.340	.945	2.256	.996	2.816	.974	.93	.3951
31	2.049	.759	2.074	.854	2.000	.814	.42	.6601
32	2.971	1.214	2.992	1.263	2.994	1.202	.01	.9898
33	3.337	1.011	3.279	1.031	3.486	1.085	.88	.4164

¹ Duncan Multiple Range Test groupings of significance are summarized in the narrative.

Significant at the .05 level was question 7 which states, "My subject area does not require my students to do much critical thinking. Most of my teaching centers around acquisition and recall of information." The Duncan Multiple Range Test shows that the mean for middle school teachers was significantly higher than the mean for elementary teachers. The mean for high school teachers fell between the other two and did not differ significantly from either of them.

Also significant at the .05 level was question 16 which states, "In the grade level(s) I teach, critical thinking should be taught in a separate course." The Duncan Multiple Range Test shows that the mean for elementary school teachers was significantly higher than the mean for middle school teachers. Again, the mean for high school teachers fell in the middle with no significant differences from the others.

Questions 24 and 25 are also significant at the .05 level. They both deal with instructional materials for teaching critical thinking skills. Question 24 states, "I have many varied commercially prepared instructional materials which provide great help in teaching critical thinking." In the Duncan Multiple Range Test, the mean for high school teachers was

significantly higher than the mean for middle school teachers. Elementary teachers fell between with a mean that was not significantly different from the other two.

Question 25 states, "I prefer to make up my own exercises, examples, and questions to teach critical thinking rather than using commercial materials." Some respondents indicated that they did this not out of preference but out of necessity. The Duncan Multiple Range Test shows that the mean for elementary teachers was significantly higher than the means for both middle and high school teachers.

Significant at the .01 level is question 10 which states, "A democracy ceases to exist when its people lose their ability to think critically. Survival of democracy, and, therefore, survival of our nation, requires critical thinking by virtually all its citizens." According to the Duncan Multiple Range Test, the middle and high school means were not significantly different from each other but were both significantly higher than the elementary school mean.

Also significant at the .01 level is question 21 which states, "In the grade level(s) I teach, critical thinking should be integrated into vocational subjects

as a primary outcome of learning." This question is one of seven with the same wording except for subject area. Question 17 suggests that critical thinking should be integrated in English courses as a primary outcome of learning. Question 18 is about social studies, question 19 is about math, question 20 is about science, question 22 is about fine arts, and question 23 is about health, physical education and driver education courses. Only question 21, about vocational subjects, shows a significant difference by teaching level. The Duncan Multiple Range Test shows that the elementary mean was significantly higher than the middle school mean. The high school mean fell between them and was not significantly different from either.

Table 15 shows the means and standard deviations of questions 3-33 by subject area assignment. Each subject area is also shown by middle and high school levels. Analysis by a general linear models procedure indicates that there are significant differences in level, in assignment, or in the interaction of level and assignment in 11 of the 31 questions.

Table 15

Means and Standard Deviations of Questions 3-33 by Assignment¹

Mean STD	English		Soc. Studies		Math		Science		Other		Level F	Level Prob	Assignment		Level*Assignment	
	Middle	High	Middle	High	Middle	High	Middle	High	Middle	High			F	Prob	F	Prob
3	1.583 .584	1.576 .502	1.556 .527	1.833 .761	1.588 .618	1.857 .727	1.842 .602	1.667 .767	1.679 .701	1.840 .782	1.09	.3367	.61	.6983	.65	.6285
4	4.792 .415	4.727 .761	4.444 .527	4.250 .897	4.412 .870	4.381 .498	3.895 1.410	4.556 .984	4.396 .947	4.346 .868	1.70	.1842	3.28	.0026	1.25	.2873
5	4.792 .415	4.758 .435	4.778 .441	4.565 .788	4.529 1.007	4.333 .913	4.421 1.700	4.500 .786	4.463 .840	4.188 1.148	1.34	.2626	2.98	.0119	.35	.8473
6	2.292 .908	2.152 .972	1.778 .441	2.042 .955	2.412 1.176	2.238 1.044	2.158 .688	2.000 .840	2.093 .807	2.325 .897	1.62	.1989	.98	.4294	.80	.5237
7	4.000 1.022	4.121 1.053	4.000 1.225	3.917 1.100	4.059 .966	4.000 .918	4.211 .787	3.556 1.247	4.000 .990	3.741 1.170	3.17	.0429	.44	.8233	.79	.5290
8	3.304 1.185	3.515 1.121	3.222 1.302	3.083 1.213	2.765 1.348	3.286 1.056	3.444 1.149	3.167 1.249	3.849 .928	3.363 1.022	2.51	.0829	2.19	.0540	2.11	.0794
9	4.696 .703	4.667 .990	4.444 1.014	4.565 .728	4.529 .624	4.300 .801	4.421 .902	4.389 1.037	4.667 .700	4.605 .606	.14	.8695	1.19	.3132	.20	.9362
10	1.750 .944	1.273 .626	1.444 .527	1.792 .977	2.000 1.275	1.952 .921	2.105 1.049	1.444 .616	1.648 .872	1.753 .799	5.37	.0050	1.87	.0976	2.95	.0200
11	2.500 1.142	2.212 1.293	2.444 .882	2.292 1.301	2.313 1.014	2.350 1.040	2.474 1.219	1.833 .924	2.148 .960	2.309 1.147	1.47	.2303	.21	.9561	1.09	.3593
12	1.750 .847	1.667 .816	1.778 .441	1.625 .647	1.353 .493	1.850 .671	1.789 .918	1.556 .616	1.717 .744	1.650 .658	.05	.9538	.15	.9790	1.47	.2116
13	2.208 1.062	2.788 1.053	2.556 .882	1.917 .776	2.588 1.064	2.381 .973	2.000 1.000	2.389 1.145	2.407 1.108	2.420 .878	.20	.8180	1.28	.2692	2.22	.0662
14	1.625 .711	1.697 .770	1.556 .527	1.792 .721	1.412 .507	2.000 .837	1.842 .834	1.611 .502	1.722 .712	1.914 .883	1.90	.1509	.79	.5576	1.51	.1994
15	1.458 .588	1.545 .711	1.333 .500	1.625 .824	1.412 .507	1.667 .796	1.737 .806	1.529 .514	1.472 .575	1.642 .747	1.22	.2949	.31	.9086	.73	.5731
16	3.958 .690	3.939 1.059	3.667 1.000	3.792 .977	3.706 1.047	3.810 .928	3.579 .902	3.778 .943	3.574 .838	3.722 .905	3.65	.0268	1.21	.3049	.11	.9775
17	1.833 .381	1.875 .609	2.111 .928	2.125 .797	1.765 .752	2.286 .717	2.530 .705	2.000 .594	2.151 .864	2.203 .758	.95	.3888	1.70	.1332	1.03	.3906
18	1.750 .442	1.833 .531	2.000 .866	1.917 .830	1.834 .728	2.238 .700	2.000 .745	1.944 .539	2.115 .900	2.139 .693	.39	.6785	2.06	.0694	.80	.5286
19	2.083 .584	2.034 .778	1.889 .601	2.125 .741	1.941 .748	2.048 .669	2.053 .621	2.000 .686	2.098 .878	2.154 .704	.24	.7902	.29	.9198	.24	.9127

Table 15 continued

Mean STD	English		Soc. Studies		Math		Science		Other		Level		Assignment		Level*Assignment	
	Middle	High	Middle	High	Middle	High	Middle	High	Middle	High	F	Prob	F	Prob	F	Prob
20	1.792	1.931	1.778	1.833	1.824	2.095	1.789	1.833	2.058	2.051	.74	.4762	1.57	.1667	.38	.8234
	.509	.651	.441	.637	.809	.625	.419	.618	.873	.638						
21	1.875	2.103	2.222	2.292	1.882	2.238	1.947	2.056	2.115	2.177	4.38	.0132	1.29	.2676	.34	.8514
	.537	.772	.972	.806	.781	.700	.405	.639	.855	.747						
22	1.833	2.103	2.222	2.083	1.941	2.281	2.053	1.944	2.115	2.266	2.56	.0785	.86	.5071	.93	.4465
	.565	.772	.972	.776	.827	.805	.524	.539	.900	.780						
23	1.958	2.138	2.222	2.292	1.941	2.476	2.053	2.000	2.231	2.103	2.22	.1096	.71	.6155	1.64	.1635
	.624	.693	.972	.751	.827	.814	.524	.686	.899	.656						
24	3.250	3.667	2.667	3.591	3.118	3.524	3.105	3.563	3.113	3.260	3.94	.0203	1.37	.2355	.86	.4864
	.794	1.216	1.225	.959	.857	.928	.875	1.094	1.138	.979						
25	2.833	2.333	2.111	2.667	3.412	2.952	2.222	2.722	2.377	2.633	3.78	.0236	4.02	.0015	4.23	.0023
	.963	.890	.782	.868	1.064	.805	.428	.895	.686	.771						
26	3.500	3.424	3.222	3.091	3.529	3.524	2.895	3.313	3.415	3.538	.60	.5479	1.45	.2052	.36	.8369
	.845	1.347	1.093	1.192	1.231	1.078	.875	1.250	1.151	1.065						
27	2.348	2.455	2.444	2.458	2.529	2.650	2.579	2.389	2.472	2.519	2.48	.0850	.30	.9146	.27	.8965
	.647	.938	1.014	.721	.800	.671	.607	.850	.799	.700						
28	2.375	2.273	2.333	2.542	3.000	2.714	2.316	2.667	2.642	2.513	2.39	.0939	1.56	.1696	.80	.5231
	.711	.944	1.000	.884	1.033	1.007	.671	1.138	.942	.825						
29	3.000	2.758	2.778	3.375	2.941	3.050	3.000	2.778	2.981	2.861	.61	.5463	.66	.6580	.88	.4738
	.933	1.200	1.302	.924	1.088	1.146	.816	1.215	1.028	1.059						
30	2.042	2.000	2.677	2.417	2.412	2.619	2.263	2.222	2.231	2.089	.93	.3951	2.54	.0280	.30	.8797
	.751	.829	1.500	1.176	1.004	1.117	.933	1.003	1.022	.894						
31	2.000	1.750	2.556	2.042	1.882	2.429	2.053	1.778	2.094	2.013	.42	.6601	2.63	.0236	2.20	.0689
	.780	.718	1.333	.751	.697	.978	.524	.647	.925	.824						
32	3.083	2.242	3.000	2.917	2.765	2.857	2.947	3.111	3.038	2.910	.01	.9898	.62	.6850	.21	.9355
	1.283	1.146	1.414	1.213	1.300	1.276	1.129	1.491	1.300	1.130						
33	3.333	3.636	2.667	3.167	3.353	3.762	3.158	3.389	3.377	3.364	.88	.4164	1.43	.2103	.58	.6765
	.963	1.168	1.225	1.129	1.169	1.091	1.015	1.145	.985	1.012						

¹Duncan Multiple Range Test groupings of significance are summarized in the narrative.

The means for question 4 show significant differences at the .01 level when analyzed by assignment. Question 4 states, "I rarely use critical thinking skills in the performance of my job." The Duncan Multiple Range Test indicates that the mean for English teachers was significantly higher than the mean for science teachers. Means for social studies, math, and other teachers are similar to each other and fall between the means for English and science teachers but are not statistically different from either of them.

Question 5 is also significant at the .01 level when analyzed by assignment. Question 5 states, "The circumstances of my job (e.g., the students I teach, the subject area, and so on) do not require that I use critical thinking skills very often." The Duncan Multiple Range Test does not show differences among means. This indicates that, while the differences may be statistically significant, they are not sufficiently substantial to show up on a post hoc test.

Question 7 was found to be significant ($p < .05$) by teaching level and is reported in Table 14. Question 8 was found to be significant by assignment at the .05 level but shows no differences on the Duncan Multiple

Range Test. Question 8 states, "The amount of material I have to cover forces me to teach more for acquisition and recall of information than for critical thinking."

The significance by level of question 10 was reported in the discussion of Table 14. It is also significant ($p < .05$) when analyzed by the interaction of level and assignment. The Duncan Multiple Range Test shows no differences among means for the interaction of level and assignment for question 10. The significance levels of questions 16, 21, and 24 are reported in Table 14.

Question 25 is significant on all three analyses. Its significance by teaching level was reported in the discussion of Table 14. It is significant at the .001 level when analyzed by assignment. The Duncan Multiple Range Test indicates that the mean for mathematics teachers was significantly higher than the means for all other subjects. The means for English, social studies, and other teachers fell below the mathematics mean but not significantly above the science mean. The science mean is significantly lower than the mathematics mean, but not statistically different from the others. Question 25 is significant at the .01 level by the interaction of level and assignment. The Duncan

Multiple Range Test indicates that the middle school mathematics mean was significantly higher than the means for middle school science, social studies, and other teachers, and high school English teachers. There were no significant differences among the means for middle school English teachers and high school science, social studies, and other teachers.

Question 30 states, "My college and graduate schooling have had a great impact on my beliefs about critical thinking." It shows statistically significant differences ($p < .05$) when analyzed by assignment. The Duncan Multiple Range Test indicates that the mean for mathematics teachers was significantly higher than the mean for English teachers. The means for social studies, science, and other teachers fell between.

Question 31 states, "My job responsibilities have had a great impact on my beliefs about critical thinking." This question is significant at the .05 level when analyzed by assignment. The Duncan Multiple Range Test does not show significant differences among means. The differences are statistically significant, but not large enough to be revealed by a post hoc test.

Analysis of Question 34:

Activities to Teach Critical Thinking Skills

The final section of the Critical Thinking Survey consists of one question. It lists ten activities that might be used for teaching critical thinking skills to students and three blank lines for others to be added by participants if they so choose. Participants were asked to leave blank any that do not apply and to rank order the ones they find most useful or effective. Many participants did not rank order, but simply checked off those that applied to them. Because of this, analysis by rank order was not attempted. Any activity that received a check or a number was counted in the frequency distribution.

Table 16 shows the frequency distribution of activities to teach critical thinking by teaching level. "Asking questions" was the first choice overall, chosen by 95% or more of the respondents at all levels. Next most popular choice (84%) was "assigning problems to solve on their own." The least favored activity was "having them work at it over and over again" (37%). "Giving ditto work sheets," "doing crossword or other puzzles," and "having them work at it over and over again" were chosen by under half of the respondents.

Chi-square analyses performed on the frequency distributions indicated several significant differences by teaching level ($df = 2$) and by subject area assignment ($df = 4$). Table 16 shows the distribution of activities to teach critical thinking by teaching level. "Conducting classroom debates" is significant at the .001 level. Almost 63% of high school respondents use this activity, while 57% of middle school and 39% of elementary school respondents do.

Significant at the .0001 level is "playing games." It is the elementary teachers who use this one most often, at 76%. Fifty-seven percent of middle school teachers and 48% of high school teachers report using this activity.

Table 17 shows the frequency distribution of activities to teach critical thinking by subject area assignment. Removal of the elementary teachers from the analysis did not change the order of the choices. Mean percentages differed from a minimum of .5% ("modeling how to use critical thinking skills") to a maximum of 9% ("playing games").

Table 16

Distribution of Activities to Teach Critical Thinking
by Level

Activity	Level			Chi-Sq	Prob
	Elem. n=106	Middle n=123	High n=179		
Asking questions	99 95.19	119 98.35	172 94.85	5.511	.2387
Giving ditto work sheets	47 45.19	59 48.76	84 48.28		
Assigning problems to solve on their own	88 84.62	104 85.95	140 80.46	3.979	.4089
Conducting classroom debates	41 39.42	69 57.02	109 62.64		
Answering end of chapter questions for further thinking	59 56.73	66 54.55	104 60.12	0.942	.6245
Doing crossword or other puzzles	56 53.85	57 47.11	76 43.68		
Playing games	79 75.96	69 57.02	84 48.28	20.591	.0001
Modeling how to use critical thinking skills	67 64.42	79 65.29	103 59.20		
Explaining how these skills work	47 45.19	65 53.72	90 51.72	1.775	.4116
Having them work at it over and over again	34 32.69	49 40.50	65 37.36		

Table 17

Distribution of Activities to Teach Critical Thinking
by Subject Area Assignment

Activity	Assignment					Chi-Sq	Prob
	English n=57	Soc St n=33	Math n=38	Science n=37	Other n=135		
Asking questions	55	32	37	36	129		
	96.49	96.97	97.37	97.30	97.73	11.172	.1921
Giving ditto work sheets	27	18	20	14	63		
	49.09	56.25	54.05	37.84	47.73	10.370	.2400
Assigning problems to solve on their own	47	23	35	34	103		
	85.45	71.88	94.59	91.89	78.03	17.443	.0258
Conducting classroom debates	41	23	15	17	80		
	74.55	71.88	40.54	45.95	60.61	15.640	.0035
Answering end of ch. quest. for further thinking	36	16	21	27	69		
	65.45	50.00	56.76	72.97	52.67	7.043	.1336
Doing crossword or other puzzles	20	14	14	17	68		
	36.36	43.75	37.84	45.95	51.52	4.696	.3199
Playing games	22	18	19	20	73		
	40.00	56.25	51.35	54.05	55.30	4.048	.3996
Modeling how to use crit. thinking skills	42	21	19	23	75		
	76.36	65.63	51.35	62.16	56.82	8.194	.0847
Explaining how these skills work	29	18	16	18	72		
	52.73	56.25	43.24	48.65	54.55	1.884	.7571
Having them work at it over and over again	21	8	17	15	52		
	38.18	25.00	45.95	40.54	39.39	3.439	.4873

Only two activities showed significance by assignment. Significant at the .05 level is "assigning problems to solve on their own." It is the math teachers who use this most often, at almost 95%, and the social studies teachers who use it the least often, at 72%. Science teachers are second highest with 92%, followed by English teachers at 85% and other teachers at 78%.

Also significant by assignment as well as by level is "conducting classroom debates." English teachers report using this activity most often at almost 75%, and social studies teachers at 72%. Almost 61% of other teachers use this activity, while 46% of science teachers and 40% of math teachers use it.

Summary

This chapter has presented the data analysis for this study in five sections. Demographic variables were shown in frequency distribution tables and were used only to describe the population sample. Participants' definitions of critical thinking were shown in frequency distribution tables by level and assignment. Participants' identification of critical thinking skills were shown in frequency distribution tables and

further analyzed with chi-square procedures. Questions dealing with the importance of critical thinking in participants' professional and personal lives were analyzed with frequency distributions and general linear models procedures and further defined through the post hoc Duncan Multiple Range Test. And finally, participants' choices of activities to teach critical thinking were shown in frequency distribution tables and further analyzed with chi-square procedures.

CHAPTER V
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter is divided into three sections. The first section summarizes the purpose and procedures of the study, the second section indicates conclusions drawn from the findings, and the third section offers recommendations for using the findings and for further research.

**Summary of the Purpose and
Procedures of the Study**

The purpose of this study is to describe teachers' attitudes toward critical thinking: their definitions of critical thinking, the importance of critical thinking in their daily lives, how important it is to them that their students use critical thinking skills in class, whose responsibility it is to teach critical thinking skills to students, and who or what has influenced teachers' attitudes about critical thinking.

The population selected for this study consists of

elementary, middle, and high school teachers from a large school division in central Virginia. A large sample of the population was carefully chosen on the basis of balanced demographic data. Nine schools were selected to participate in the study: five elementary schools, two middle schools, and two high schools. They represent a cross-section of socioeconomic levels in a school division that has urban, suburban, and rural influences. The sample is composed of 106 elementary school teachers, 123 middle school teachers, and 179 high school teachers.

Data for the study were gathered through a questionnaire, the Critical Thinking Survey, developed by this researcher. The survey was developed and tested during the summer 1985. The topics around which the questions were constructed were identified through a review of the literature. Content validity of the questions was established by a panel of experts (n=3). Wording of the questions was derived from interviews with elementary, middle, and high school teachers. After the questions were constructed, further criticism for content validity, clarity of wording, and precision of meaning was provided by an expanded panel of experts (n=6).

As a result of the panel's suggestions, a second form of the survey was constructed. Both forms were pilot tested, and participants were asked to indicate which form they preferred. The first form used a multiple choice format. Four or more possible responses, usually in the form of sentences or phrases, were offered for each question. In addition, a space was provided for participants to write their own responses in the event that the ones printed did not satisfactorily express their viewpoints. The second form used a Likert scale of strongly agree, agree, have neutral feelings, disagree, and strongly disagree. Questions were written in the form of statements, many of which were taken verbatim from the sentence responses to the questions on the first form.

The second format was chosen for the final form of the survey. In the pilot testing, a correlation coefficient of .87 was achieved.

After securing permission from the school division to conduct the study, this researcher prepared the surveys and hand delivered them to the participating schools along with a letter of instructions to be read to the teachers by the principal or the principal's designee. Because the surveys were completed by

teachers and collected during faculty meetings, non-response was negligible.

Conclusions of the Findings

Five aspects of teachers' attitudes about critical thinking were investigated. The first is the definition of critical thinking.

A review of the literature indicates that there is a lack of consensus about a definition for critical thinking. Not available in the literature, however, are the criteria for consensus. What percentage of experts, specialists, or practitioners have to agree before consensus is reached? Is it enough to show a simple majority? Or perhaps a two-thirds majority? Or is consensus a more rigorous term requiring the agreement of virtually everyone concerned? The American Heritage Dictionary of the English Language defines consensus as collective opinion or concord, general agreement or accord. In this researcher's mind, such a definition requires more rigor than a simple or even two-third's majority.

Researchers like to see a correlation coefficient of .70 or above in validity and reliability data. For purposes of this discussion about consensus with regard

to definition, the 70% agreement implied in a .70 correlation coefficient will be set as a standard for evaluating consensus although this standard is arbitrary and artificial, and probably quite generous. For life-threatening and similarly urgent situations, a more rigorous standard for consensus would likely be set.

The results show that the definition endorsed by experts (definition B in this study) is the majority choice across teaching levels and subject area assignments; however, it falls short of consensus. It scores at least 50% but not more than 64% in any category of level or assignment. One can draw the conclusion, then, that as many as half and as few as a third of the respondents do not agree with this definition. Choices for the definition based on Bloom's Taxonomy (definition A in this study) range from about 20% to about 30% in both level and assignment, with English teachers showing about 33%. The definition more suggestive of creative thinking than of critical thinking (C in this study) is chosen by just under to just over 13% of the participants at all levels. By assignment, the range is from 7% to 17%.

The results of this study seem to confirm a lack

of consensus among practitioners with regard to definition. Beyer (1985, p. 271) sheds some light on this phenomenon by explaining what critical thinking is not: "Equating critical thinking with all other kinds of thinking or with Bloom's list of skills, inquiry, decision making or problem solving is incorrect. Such practices blur the essential distinctions between these various kinds of thinking. They also lull teachers into believing that by teaching these other skills, they are really teaching critical thinking, when in fact they are not" (p. 271).

A further example of inconsistency of definition can be seen in teachers' identification of critical thinking skills. Participants were asked to identify critical thinking skills from among 23 learning skills listed. Only 10 of the 23 are identified as critical thinking skills by the experts. Beyer has compiled lists of critical thinking skills from seven sources from 1954 to 1982 (p.273). As few as five and as many as 12 critical thinking skills are identified by each expert or team of experts. Nowhere on these lists are reading, listening, decision making, problem solving, identifying main idea, predicting outcomes, comparing and contrasting, brainstorming, looking for

alternatives, or hypothesizing. Even though these are not considered critical thinking skills by the experts, at least 70% of the participants at one or more of the teaching levels or in one or more of the subject area assignments identified them as such.

This suggests that teachers are equating several types of thinking with critical thinking, just as Beyer has indicated. This is not surprising, given the example set in some recent publications in which critical thinking and other types of thinking are often discussed in adjacent articles and sometimes within the same article. In many cases, no distinction is made among the types of thinking being discussed. It is understandable that readers would tend to think the authors and publishers are presenting many varied thinking skills as critical thinking skills. This is not to say that the literature is at fault for the confusion surrounding the definition of critical thinking. It may simply be that the literature mirrors the lack of consensus among practitioners in the field.

Identifying as critical thinking skills those which are not is only part of the problem. Conversely, some of the skills that should have been identified, according to the experts, as critical thinking skills

were not identified by 70% of the participants at all teaching levels or in all subject area assignments. These include determining the strength of a statement or an assertion, identifying unstated opinions, determining the reliability of a source, identifying ambiguous or equivocal claims or assertions, and stating conclusions.

Of the 14 skills that meet the criterion for achieving consensus, i.e., chosen by at least 70% of the total respondents (but not necessarily by 70% of respondents at each level or in each subject area assignment), eight of them are critical thinking skills as defined by Beyer and others (1985, p. 271, 273). Only two critical thinking skills are not identified as such by consensus of the participants: identifying unstated opinions and stating conclusions.

These findings indicate that practitioners at all three levels and across all subject area assignments tend to define critical thinking very broadly. In fact, all but two of the skills show a mean percentage of at least 60. More than half of the participants identified every listed skill except sounding out words and memorizing as a critical thinking skill. Overall, teachers seem not to be knowledgeable about the

specific skills one must use when thinking critically. Such a finding is consistent with the literature, not only of today, but of past decades as well.

The importance of critical thinking. The second aspect investigated is the importance of critical thinking in teachers' daily lives. Regardless of what their definitions may be, teachers at all teaching levels and across all subject area assignments reported that critical thinking is very important in their lives. The rate of agreement with the positively worded questions that dealt with this aspect and the rate of disagreement with the negatively worded questions (about 90%) well exceeds the arbitrary standard set for evaluating consenses (70%). This is not surprising, and it is quite consistent with the literature.

If the teachers' responses represent an accurate assessment of their actions, there is widespread use of critical thinking skills among teachers at all grade levels and across all subject areas. The literature does not fully support this concept. It suggests, instead, that just as students vary in their abilities and willingness to use critical thinking skills, so do teachers and other adults (Hunt & Germain, 1969; Martin, 1984; Norris, 1985). Perhaps future research

can attempt to match teachers' actions with their perceptions of their actions.

Importance of student use of critical thinking.

The third aspect investigated is how important it is to teachers that their students use critical thinking skills in class. Among the questions that showed significant differences, one suggests that the participant's subject area does not require the students to do much critical thinking, but rather, calls for more acquisition and recall of information. Because this question is worded negatively, it calls for a disagreement to indicate that a participant's subject area requires a student to think critically. While this question does not elicit strong disagreement from any level, it is the middle school teachers who show the greatest tendency to disagree, or, rather, the greatest indication that their subject areas require critical thinking. This could be due to the school division's strong commitment to the middle school concept which advocates meeting the developmental needs of emerging teenagers. These students are in a transition between childhood and adulthood and are searching for their own identities. Good middle school teachers encourage them to ask questions and weigh

carefully all the information they receive. This is especially important for dealing with peer pressures regarding sex and drugs. The middle schools in this school division have been implementing the middle school concept for nearly a decade.

Means show that elementary teachers are the ones who agree most strongly with the idea that a democracy ceases to exist when its people lose their ability to think critically. This is one of several questions which show greater commitment to critical thinking by elementary teachers than by middle and/or high school teachers. This may be due to an elementary teacher's greater commitment to teaching the child than to teaching the subject matter.

Overall, teachers are not as definite about the importance of student use of critical thinking than with their own use. Mean percentage of agreement on the questions which measure this aspect indicates consensus at about 76%, yet only 54% report assessing the extent to which their students think critically in the classes they teach. If critical thinking is important for students, why is student use of critical thinking skills not being systematically assessed? Teachers can not know the extent to which a concept is being learned

or a skill being practiced without some type of assessment procedure. It appears that lip service is being paid to student use of critical thinking, but perhaps it is not really being fostered to the extent that teachers believe it is.

Responsibility for teaching critical thinking. The fourth aspect of teachers' attitudes deals with who has the responsibility for teaching critical thinking. There are several important findings related to this aspect. First, teachers seem willing to accept the responsibility to teach critical thinking to students. Overall, the teachers fall just short of consensus (64%) that the schools have the primary responsibility for teaching critical thinking, but they well exceed the minimum standard when they agree that such instruction should begin in the primary grades (89%), and that it should continue through grade 12 (94%).

Second, the teachers think that instruction in critical thinking should be integrated into subject area courses. They generally disagree, but are just short of consensus (68%), with the idea that critical thinking should be taught in a separate course. There is agreement that critical thinking should be integrated into English/language arts, social studies,

mathematics, science, vocational subjects, fine arts subjects, and health, physical education, and driver education courses as a primary outcome of learning.

Two findings could be important to teacher trainers. The only significant difference among teachers with respect to integrating critical thinking skills into the subject area courses deals with vocational subjects. Elementary teachers were less positive about this, probably because it did not apply to the grade levels they teach. Teacher trainers and staff development personnel should inform elementary teachers of the critical thinking needs and possibilities among the vocational subjects even if these subjects are not taught in their schools. Elementary teachers have both the opportunity and the responsibility to lay the groundwork for much instruction that comes later. They should begin to prepare children to think critically in all aspects of their lives, including those areas which would be considered vocational.

Another finding of importance to teacher trainers deals with differences in the activities teachers use to teach critical thinking skills. If, as McPeck (1981) suggests, critical thinking is thinking critically

about something rather than just thinking critically in general, then different disciplines might require different processes and, perhaps, different skills. Surely, they might also require different teaching approaches.

A fifth important finding deals with the availability of commercially prepared instructional materials for teaching critical thinking. About half of the teachers reported that such materials are not readily available. About half of the teachers also reported that they make up their own questions and exercises. Several respondents said they did so from necessity rather than from preference. Writers and publishers of curriculum materials should address this deficiency.

Influence on teachers' attitudes. The final aspect that was investigated deals with who or what has influenced teachers' attitudes about critical thinking. Elementary and secondary schooling do not appear to have had much impact on teachers' attitudes about critical thinking, but there is consensus that college, graduate school, and job responsibilities have had a great impact.

About half of the respondents reported that they

had not had feedback from an administrator or another observer about their ability to teach critical thinking. Half of them also said they had not received enough professional training for teaching critical thinking.

These are very important findings. Teacher trainers and staff development personnel can take advantage of their potential impact on teachers' attitudes. Teacher trainers must carefully examine their own programs for ways to increase the amount and quality of training that teachers receive for teaching critical thinking. Staff development personnel in the school divisions must do the same with their inservice programs. Administrators and supervisors must be taught how to gather data on thinking skills teaching models as well as on direct instruction teaching models. They must be taught how to encourage the teaching of critical thinking in the classroom and how to foster its increased use through proper supervision.

An especially interesting finding deals with teachers' attitudes about their own abilities to teach critical thinking. Almost half say they are good teachers of critical thinking. Only 8% say they are not. Although half of the teachers have not been

adequately trained and half have not been told whether or not they are good at teaching critical thinking, many of them believe that they are.

Summary. Five aspects of teachers' attitudes toward critical thinking were investigated. The first is definition. Although most of the teachers in this study, across all levels and assignments, chose the definition that Beyer suggests is typical of the specialists in the field today, a sizable percentage of the teachers (42%) did not choose this definition. This indicates a wide difference of opinion among teachers as to what constitutes critical thinking. Given the existing inconsistencies in the current literature, it might be expected that the lack of consensus from this study is congruent with the lack of consensus in the field.

A second aspect is importance of critical thinking in teachers' daily lives. Across all teaching levels and subject area assignments, teachers reported a high degree of importance.

A third aspect is importance to teachers that their students use critical thinking in class. Again, across all levels and assignments, teachers reported a high level of importance, yet did not report a high

level of assessment for critical thinking among their student evaluation procedures. This could indicate an inconsistency between what is reported and what is actually done.

A fourth aspect is responsibility for teaching critical thinking. In general, teachers at all levels and in all subject areas accept the responsibility for teaching critical thinking. They agree that instruction should begin in the primary grades and continue through graduation from high school.

The fifth aspect is influences on one's attitudes about critical thinking. Elementary and secondary schooling seem to have little impact, but college, graduate school, and job responsibilities seem to have a great impact teachers' attitudes about critical thinking. Teachers reported little feedback from administrators about their abilities to teach critical thinking and little professional training in how to teach it, but showed confidence in their abilities, nevertheless.

The findings of this study underscore some of the uncertainty and inconsistency in the critical thinking field as reported in the literature. They also indicate that there are very few differences among teachers'

attitudes about critical thinking when compared by teaching level and by subject area assignment. The findings themselves might indicate why this is true. Teachers reported that college, graduate school, and job responsibilities all had a great impact on their attitudes toward critical thinking. Typically, only a small portion of the education course hours is spent in methods courses for a specific grade level or subject area. As a rule, prospective teachers of all grades and subjects take much of the same coursework in professional education. Once they become teachers, they are exposed to much of the same in-service programming. Models of teaching are often categorized as information processing models, behavioral models, interaction-oriented models (Joyce & Weil, 1980), or teacher decision-making models (Hunter, 1983), for example. Teachers may be trained in direct instruction models or thinking skills models, but not likely in "third grade teaching models" or "math teaching models." Such preservice and inservice training would tend to foster similarities in approach and attitude, not differences.

Recommendations

This section will make recommendations for

implementing the findings of this study, for further analysis of the data, and for further research.

For implementing these findings. Findings from this study can be used by those persons who have the responsibility to train teachers to implement programs for teaching critical thinking. The teachers in this study have reported a high level of importance of critical thinking in their own lives and in their classes. They have also reported that they have not received much feedback or training with regard to teaching critical thinking. They appear willing not only to teach critical thinking to their students but also to receive some help in doing this.

Their college and graduate schooling have had a great impact on their attitudes about critical thinking. Teacher educators might use these findings to increase the attention given to critical thinking in methods courses. Graduate programs for administrators might focus part of their instruction on observation and supervision of thinking skills teaching models. Much of the current observational technique focuses on direct instructional models.

Certainly these recommendations are more easily made than accomplished. It is entirely possible that

teacher educators do not know how to teach teachers to teach critical thinking. It is also possible that teachers of administration and supervision courses do not know how to gather and analyze data from a thinking skills teaching model. If these potential problems can be overcome, college and graduate schooling can have an even greater impact on teachers' attitudes and abilities to teach critical thinking.

Because job responsibilities have also had a great impact, department chairmen, building administrators, subject area supervisors, and staff development specialists can use these findings to plan in-service programs designed to help teachers teach critical thinking. Curriculum specialists and writers and publishers of textbooks and other instructional materials can use these findings to determine needs among teachers for adequate materials to teach critical thinking.

Perhaps the most noteworthy of the findings is the discrepancy among teachers with regard to the definition of critical thinking and the identification of critical thinking skills. Any person responsible for designing a program to improve teachers' abilities to teach critical thinking must first establish a base

from which to work. Somehow, a common definition must be found, and specific critical thinking skills must be identified. Once all participants are speaking the same language, a program can be developed and implemented.

A caution is in order here. The findings of this study must not be interpreted to mean that critical thinking as defined by the specialists cited by Beyer is the only type of thinking that should be taught. Beyer has stated that teachers teach other types of thinking under the mistaken impression that they are teaching critical thinking. He does not say that teachers should not be teaching those kinds of thinking. Nor does anyone suggest that teachers should not teach creative thinking as defined by deBono (1969) and others. Thinking skills teaching models should be added to the instructional program to coexist with direct instructional models--not to replace them nor be eclipsed by them. Too often, educators swing with the either-or pendulum.

With the cautions noted, recommendations for using the findings of this study are as follows:

1. Based on teachers' willingness to teach critical thinking skills and their perception that their professional training for the task is inadequate,

teacher educators and teachers of administration and supervision courses should re-examine their curricula to determine the extent to which critical thinking skills are modeled by the instructors, taught to and expected of the college and graduate students, and explained and demonstrated in teaching methods. This is consistent with the findings of Ashby-Davis (1984), Constantine (1968), and Hunt and Germain (1969) who also ask, "Who will teach the teachers' teachers?" (p. 8).

2. Administrative and supervisory personnel in local schools and school divisions should re-examine their supervisory and observational procedures to determine if they are adequate for observing and supervising thinking skills models as well as direct instructional models in order to provide feedback to teachers about their teaching of critical thinking.

3. Designers and developers of in-service programs on the teaching of critical thinking should establish a working definition of critical thinking to be used in the program and should identify the skills to be taught, congruent with that definition. It is recommended that the definition most accepted by the experts, (definition B in this study) be given strong

consideration. If the problem of inconsistency is to be overcome, teacher trainers must take a strong stand toward achieving consensus. Only then will teachers be able to read the literature and converse with one another at the same level of understanding of definition, skills, and concepts related to critical thinking. Once the training definition is established, variations for grade level and subject area should be determined according to student maturity and content area concepts to be taught. Careful attention should be given to the literature on change and innovation when establishing and implementing foundational guidelines.

4. Respect should be paid by all persons involved in the development and teaching of critical thinking programs to all the viewpoints expressed in the literature. Care should be taken to insure that no one type of thinking nor approach to teaching should be used or fostered to the exclusion of all others. Each study or program reported in the literature makes a point with regard to its merits. Those points should be considered and weighed in light of an organization's needs. In short, critical thinking should be applied.

For further analysis. As this study was being undertaken, interesting and important questions arose

in addition to those questions being researched. Further analysis of the data might prove beneficial in the following areas:

1. Relationships among the dependent variables might be sought and analyzed, for instance, relationships between definition and skills, definition and importance, definition and teaching methods, skills and importance, skills and teaching methods, and importance and teaching methods.

2. Further analysis and compilation of the data focused more on specific grade levels and subject areas might reveal a profile of teachers by grade level and subject area.

For further research. It is not surprising to this researcher, based on a review of the literature, that an inconsistency with regard to definition exists among the teachers in this study. It is recommended that this study be replicated in other school divisions in different parts of the country to see if the same findings will result. These findings should have a reasonably high degree of external validity because the sample was large and it represented a cross section of socioeconomic levels. Perhaps a sample can be obtained that will retain these strengths while adding a higher

percentage of men and ethnic minorities. It is also important to follow up questionnaire responses with observations and other data to establish the validity of the instrument.

Further research might refine the Critical Thinking Survey itself to determine if there is a way to diminish the incorrect following of the instructions that was present in the demographic section and on question 34. An additional concern is the widespread lack of response to the age category.

In survey research, the researcher must rely on participants' self-reports. Further research might seek to verify, through observation and other data, the extent to which critical thinking is actually present in the curricula and daily lessons of teachers. It might also seek to verify which activities are actually used to teach critical thinking. Such research might reveal any possible discrepancies between what the teachers say they are doing and what they are actually doing.

Further research might be carried out among college and graduate school teachers to determine if there is more consensus with regard to definition and identification of skills among that group than among

elementary, middle, and high school teachers. Also of interest and importance is the nature of activities college and graduate school personnel use to teach and foster critical thinking. Additional research at the college level could focus on discrepancies between what professors report and what they actually do.

If the teaching of critical thinking is to be increased in quantity and improved in quality, the teachers must be taught how to accomplish this. According to Dewey and others, a major component of critical thinking is attitude--the willingness to think critically. The findings of this study show that teachers report a willingness to think critically and to teach their students to think critically. They also report confidence in their abilities to teach critical thinking, yet not much training or feedback. In order to capitalize on this very important component of attitude, teacher educators and staff developers can use these findings and the findings of other studies to increase the training and feedback, which, at this point, are judged inadequate by teachers.

The findings of this study indicate that teachers are willing to teach critical thinking--in fact, believe it is their responsibility. It is always easier

to teach someone who wants to learn than someone who shows no interest. The future is bright.

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APPENDIX A

Interview Guide

Summary of Activities Leading to Development of Critical
Thinking Survey

Critical Thinking Survey

Letter to Participating School Principals

3. Based on the preceding definition, how important is critical thinking in your professional life?

4. How important is critical thinking in your personal life?

5. How important is it to you that your students use critical thinking skills in your classes?

6. How important is it to our survival as a nation that all our young people learn to think critically?

Now I'm going to give you a definition for critical thinking that is fairly standard in the literature, and I'd like you to use it as your frame of reference as you answer the rest of the questions.

Critical thinking is the assessing of the authenticity, accuracy and/or worth of knowledge claims and arguments. It calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends.

Critical thinking is a collection of separate skills or operations each of which involves some degree of analysis and evaluation. The following skills seem to represent the core of these operations:

- * Distinguishing between verifiable facts and value claims.
- * Determining the reliability of a source.
- * Determining the factual accuracy of a statement.
- * Distinguishing relevant from irrelevant information, claims, or reasons.
- * Detecting bias.
- * Identifying unstated assumptions.
- * Identifying ambiguous or equivocal claims or arguments.
- * Recognizing logical inconsistencies or fallacies in a line of reasoning.
- * Distinguishing between warranted and unwarranted claims.
- * Determining the strength of an argument.

SUMMARY OF ACTIVITIES LEADING TO DEVELOPMENT OF CRITICAL THINKING SURVEY

Pat Walker

This summary is divided into two parts: (1) a chronology of the activities supporting the development and pilot testing of a critical thinking survey instrument and (2) a summary of the interviews that led to the development of the instrument.

Chronology of Activities

On July 1, 1985, my dissertation committee approved the prospectus for my study entitled Description of Teachers' Attitudes About Critical Thinking. The purpose of this study is stated as follows: This study will describe teachers' attitudes toward critical thinking: their definitions of critical thinking, the importance of critical thinking in their personal and professional lives, how important it is to them that their students use critical thinking skills in class, whose responsibility it is to teach critical thinking to students, and who or what has influenced teachers' attitudes about critical thinking.

My methodology specified that I would interview 10 to 12 teachers and use the results of those interviews to help me construct a questionnaire that would gather data to satisfy my stated purpose. I submitted the Interview Guide (enclosed) to Drs. Jim McMillan and Jim Hodges of Virginia Commonwealth University and Dr. Jerry Bracey of the Virginia Department of Education for their comments regarding content validity. Based on their suggestions, I revised the guide and conducted interviews with four elementary school teachers, three middle school teachers, and four high school teachers, for a total of 11.

The results of these interviews led to the development of the Critical Thinking Survey (enclosed) which I am now submitting to a panel of experts for further comment regarding content validity and clarity of wording. This panel consists of Drs. Jim McMillan, Jim Hodges, and Don Forsythe of Virginia Commonwealth University, Dr. Barry Beyer of George Mason University, Mrs. Anne Venturino of Henrico County Schools, and Dr. Jerry Bracey of the Virginia Department of Education.

I will revise the instrument according to the suggestions from the panel of experts and will then pilot test it with a group of 20-25 teachers, seven or eight from each of the elementary, middle, and high school teaching levels. I will ask these teachers to take the survey twice, about ten days to two weeks apart, for reliability. I will use the same questions both times, but I will rearrange the questions and their responses for the second testing.

Summary of Interviews

As a result of the 11 interviews, the 20 questions in the Interview Guide were rewritten to become the 18 questions in the Critical Thinking Survey. In the Interview Guide, all questions were open-ended. They were phrased as questions, and no response choices were given. The interviewees unanimously suggested that answer choices be provided. They felt, as did I, that an instrument with 20 open-ended questions would be very unpopular with respondents and that I would not get a favorable return rate. Nor would I likely get complete, well thought out answers from all those who did respond.

The interviewees agreed that I should ask questions 1 and 2 before I provided a definition of critical thinking and critical thinking skills. Two respondents suggested

that those questions might be left open-ended for teachers' unbiased answers, but the majority felt that I should offer the choices that seemed to reflect the differences in current opinion on what critical thinking is. All felt that I should leave space for survey respondents to write their own answers in the event that the choices I provided did not reflect their attitudes.

Interviewees did not favor a number scale to indicate level of importance of the particular topics of the questions. If the questions were to be worded in the survey as they were in the interview guide, then response choices should be expressed in words. Some suggested value scales such as "very important-somewhat important-of little importance-of no importance." Or the questions could be reworded to allow "strongly agree-agree-no opinion-disagree-strongly disagree" or "frequently-sometimes-seldom-never."

The majority of interviewees strongly favored choices that offered specific examples or expressed a specific line of reasoning. This is the path I chose to follow. It took quite a long time to prepare such responses, and will take survey respondents longer to read and analyze, but interviewees felt that responses of this type would help respondents be more honest and accurate.

Three interviewees suggested that the questions and responses should be worded differently from each other to forestall an unconscious search for patterns. For instance, some questions could call for the most applicable response, while others could call for "all that apply," while still others might require a rank ordering, and so on. One interviewee suggested that even the order of the responses be varied so that high value responses did not always appear before low value responses or vice versa. Even though this technique was suggested by only a few interviewees, I thought it was quite insightful and chose to follow it.

For the most part, the interviewees favored the order of the questions. They could recognize that some of the questions were related to each other and that the order of questions seemed to follow a reasonable progression. Several of them did suggest that questions 19 and 20 about curriculum materials be placed after the questions about where in the curriculum critical thinking should be taught (question 12 in the survey instrument).

Most of the questions were reworded, some only slightly and some almost completely, according to suggestions from interviewees. Two questions were deleted: numbers 9 and 18 from the interview guide. I made this decision on the basis of a vague ambivalence that seemed to surround question 9's comments and responses, and a lack of necessity for question 18. Both questions could be answered in others. Question 9 overlapped with 6, 7, and 8. With regard to question 18, answers to all the other questions will reveal whether the respondent agrees or disagrees with the literature. In any event, it is an unanswerable question by a respondent if he or she has read nothing in the critical thinking literature.

Interviewees were contacted by their building administrators and asked if they would help me with my task. They are all considered "above average" by the administrators who work with them. While their opinions represent the thinking of excellent teachers, they were very conscientious in trying to anticipate the wording that would be most appropriate for the "average" teacher. To my surprise, several of them thanked me for the opportunity to participate in the interview. It seemed to be a positive experience for all of us.

CRITICAL THINKING SURVEY

Purpose: This questionnaire is designed to find out teachers' thoughts and attitudes about critical thinking. Your answers will be completely anonymous. Your participation is greatly appreciated.

Instructions: There are no right or wrong answers. Please check your choice of responses to each question. This questionnaire should take no more than 15 minutes to complete.

IMPORTANT: This questionnaire is divided into two parts. Part I responses should reflect your first reaction to the questions. Please complete Part I first. Once you have gone on to Part II, DO NOT return to Part I.

Teaching level: ___ elementary ___ middle ___ high

Elementary assignment (Please mark one): ___ Grade level classroom teacher ___ other

Middle and high school assignment (Mark only one):

___ English/language arts ___ social studies ___ math ___ science ___ other

Ethnic group: ___ White ___ Black ___ Asian ___ Hispanic ___ American Indian

Sex: ___ male ___ female Year of birth _____

Years teaching experience _____ Highest degree earned _____

Years teaching experience in main subject area _____

PART I: In this section, information is requested about the way you conceptualize critical thinking based on your experience as an educator.

1. Which of the following most closely approximates your definition of critical thinking?
 - ___ a. the higher cognitive skills identified in Bloom's Taxonomy: application, analysis, synthesis, evaluation.
 - ___ b. a persistent effort to examine any belief or statement in light of the evidence that surrounds it to assess its authenticity, accuracy, and/or worth.
 - ___ c. a refusal to settle for the one right answer, an attempt to consider alternatives that do not present themselves in formal, logical, thinking.
 - ___ d. My definition is different from these. This is my definition:

2. Which of the following do you consider to be critical thinking skills? Check all that apply.

- a. reading
- b. listening
- c. decision making
- d. problem solving
- e. sounding out words
- f. distinguishing between fact and opinion
- g. detecting bias
- h. identifying main idea
- i. identifying supporting details
- j. determining the strength of a statement or an assertion.
- k. detecting inconsistencies and fallacies
- l. predicting outcomes
- m. comparing and contrasting
- n. brainstorming
- o. identifying unstated opinions
- p. determining reliability of a source
- q. distinguishing between relevant and irrelevant information
- r. looking for alternatives
- s. identifying ambiguous or equivocal claims or assertions
- t. memorizing
- u. hypothesizing
- v. identifying a problem
- w. stating conclusions
- x. other _____
- y. other _____
- z. other _____

PART II: In this section, a standard definition of critical thinking is provided to establish a similar frame of reference for all respondents.

PLEASE DO NOT RETURN TO PART I ONCE YOU HAVE BEGUN PART II.

Please refer to the following definitions of "critical thinking" and "teaching of critical thinking" as you complete Part II of the questionnaire. While there are varying definitions of critical thinking, the following one is the most commonly accepted by researchers in the field. The definition for teaching of critical thinking will serve to clear up differences in semantics as one considers the process by which critical thinking is fostered and developed.

You might need to read the definition of critical thinking several times until you are comfortable with it and can keep the 10 core skills in mind as a frame of reference.

Critical thinking is the assessing of the authenticity, accuracy, and/or worth of knowledge claims and assertions. It calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends.

Critical thinking is a collection of separate skills or operations each of which involves some degree of analysis and evaluation. The following seem to represent the core of these skills:

1. Distinguishing between verifiable facts and value claims.
2. Determining the reliability of a source.
3. Determining the factual accuracy of a statement.
4. Distinguishing relevant from irrelevant information, claims, or reasons.
5. Detecting bias.
6. Identifying unstated assumptions.
7. Identifying ambiguous or equivocal claims or assertions.
8. Recognizing logical inconsistencies or fallacies in a line of reasoning.
9. Distinguishing between warranted and unwarranted claims.
10. Determining the strength of a statement or an assertion.

For the purpose of this survey, the teaching of critical thinking includes any process or activity planned and directed by any teacher, parent, peer, or other person which is aimed at encouraging, fostering, and/or developing the use of critical thinking by someone else. It can also include any process or activity through which one learns to think critically on his or her own.

34. Do you use any of the following methods or activities to teach critical thinking skills to your students? Leaving blank any that don't apply, rank order the ones you find most useful or effective.

- ___ a. asking questions
- ___ b. giving ditto work sheets
- ___ c. assigning problems to solve on their own
- ___ d. conducting classroom debates
- ___ e. answering end of chapter questions for further thinking
- ___ f. doing crossword or other puzzles
- ___ g. playing games
- ___ h. modelling how to use critical thinking skills
- ___ i. explaining how these skills work
- ___ j. having them work at it over and over again
- ___ k. other _____
- ___ l. other _____
- ___ m. other _____

pat walker

936 St. John's Wood Drive, Richmond VA 23225

August 26, 1985

Dear [REDACTED] Elementary School Faculty,

Your principal has given me permission to request your participation in my dissertation study. If you have ever had first hand experience with doing a research study, you know that gathering accurate, meaningful data is the key to the whole thing. That's why I'm coming to you. Teachers are probably the most meaningful aspect of the entire educational process.

My study is about teachers' attitudes toward critical thinking. The questionnaire is divided into two parts with reasonably detailed instructions for each part. Please read the instructions carefully. Of great importance is that you complete Part I before you begin Part II, and that you do not go back to Part I after you have started Part II. In Part I, I am asking for your unbiased impressions. In Part II, I give a definition which focuses your attention in a specified direction. It is important to the study that your responses to the questions follow these guidelines.

Every question has been included for a reason, including the demographic items on the first page. Please answer everything. Your answers, of course, will be completely anonymous. The survey doesn't ask for your name, social security number, or even a code number. It should take no more than 15 minutes to complete. When you have finished, turn it in to the principal or the principal's designee. I will come to the school later this week to pick up the completed forms.

I know that the beginning of the school year is not the most convenient time for teachers to be asked to do something unrelated to the pressures of opening week, but I also know the truth of the old saying, "If you want something done, ask a busy person." I would like to express my appreciation for your help in two ways. First, you should each find a small candy bar attached to your questionnaire. If it isn't there, insist on another copy. And second, I want to offer my services to each school that participates in my study. I am an independent business and education consultant, and I can give programs on a number of topics that might be both interesting and beneficial to teachers and students. After Christmas when the winter slump sets in, I will be glad to present a program at your school for either teachers or students, small group or large, designed to meet your needs and at no cost to you. I hope you will take me up on this; it's something I really like to do.

Thank you for your help. I wish you a pleasant and productive school year.

Sincerely,

Pat Walker

APPENDIX B

Table B-1: Subject Area Assignment by Age

Table B-2: Subject Area Assignment by Sex

Table B-3: Subject Area Assignment by Ethnic Membership

Table B-4: Subject Area Assignment by Years of Experience

Table B-5: Subject Area Assignment by Highest Degree Earned

Table B-6: Intercorrelations of Questions 3 Through 33

Table B-1
 Distribution of Survey Participants
 Table of Subject Area Assignment by Age

Assignment	Age						Total
	Frequency Percent	No resp.	20-29	30-39	40-49	50-59	
English	15 -	7 16.67	19 45.24	9 21.43	5 11.90	2 4.76	42 100
Soc. St.	6 -	3 11.11	12 44.44	10 37.04	2 7.41	0 0.00	27 100
Math	9 -	5 17.24	14 48.28	7 24.14	3 10.34	0 0.00	29 100
Science	6 -	4 12.90	11 35.38	9 29.03	5 16.13	2 6.45	31 100
Other	38 -	16 16.49	36 37.11	29 29.90	13 13.40	3 3.09	97 100
Total	74 -	35 15.49	92 40.71	64 28.32	28 12.39	7 3.09	226 100

Table B-2
 Distribution of Survey Participants
 Table of Subject Area Assignment by Sex

Assignment	Sex			
	Frequency Percent	No resp.	Male	Female
English	2 -	7 12.73	48 87.27	55 100
Soc. Studies	0 -	13 39.39	20 60.61	33 100
Mathematics	1 -	9 24.32	28 75.68	37 100
Science	1 -	8 22.22	28 77.78	36 100
Other	0 -	46 34.07	89 65.93	135 100
Total	4 -	83 28.04	213 71.96	296 100

Table B-3
 Distribution of Survey Participants
 Table of Subject Area Assignment by Ethnic Membership

Assignment	Ethnic Group					
	Frequency Percent	No resp.	White	Black	Asian	Total
English	7		48	2	0	50
	-		96.00	4.00	0.00	100
Soc. Studies	0		31	2	0	33
	-		93.94	6.06	0.00	100
Mathematics	5		28	5	0	33
	-		84.85	15.15	0.00	100
Science	8		27	2	0	29
	-		93.10	6.90	0.00	100
Other	10		103	21	1	125
	-		82.40	16.80	0.80	100
Total	30		234	32	1	297
	-		88.89	10.78	0.33	100

Table B-4
 Distribution of Survey Participants
 Table of Subject Area Assignment
 by Years of Experience

Assignment	Years of Experience					Total
	Frequency Percent	No resp.	0-3	4-10	11-20	
English	4 -	6 11.32	16 30.19	25 47.17	6 11.32	53 100
Soc. St.	0 -	3 9.09	12 36.36	14 42.42	4 12.12	33 100
Math	1 -	2 5.41	12 32.43	18 48.65	5 13.51	37 100
Science	1 -	4 11.11	10 27.78	17 47.22	5 13.89	36 100
Other	1 -	8 5.94	50 37.31	50 37.31	26 19.40	134 100
Total	7 -	23 7.85	100 34.13	124 42.32	46 15.70	293 100

Table B-5
 Distribution of Survey Participants
 Table of Subject Area Assignment
 by Highest Degree Earned

Assignment	Degree					Total	
	Frequency	Percent	No resp.	Assoc.	Bachelor		Master
English	1	-	0	30	26	0	56
			0.00	53.57	46.43	0.00	100
Soc. St.	0	-	0	22	10	1	33
			0.00	66.67	30.30	3.03	100
Math	1	-	0	22	15	0	37
			0.00	59.46	40.54	0.00	100
Science	0	-	0	19	18	0	37
			0.00	51.35	48.65	0.00	100
Other	2	-	1	70	62	0	133
			0.75	52.63	46.62	0.00	100
Total	4	-	1	163	131	1	296
			0.34	55.07	44.25	0.34	100

* Two Master's degrees

Table B-6

Intercorrelations of Questions 3-33

	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
3	1.00	-.28	-.38	.46	-.31	-.20	-.09	.16	.05	.34	.05	.34	.36	-.09	.25	.25
4		1.00	.42	-.26	.25	.15	.15	-.15	-.08	-.13	-.05	-.24	-.24	.12	-.18	-.18
5			1.00	-.41	.46	.25	.17	-.10	-.04	-.21	.02	-.30	-.32	.16	-.13	-.16
6				1.00	-.53	-.41	-.14	.22	.10	.19	.18	.30	.34	-.05	.17	.23
7					1.00	.49	.14	-.05	.03	-.14	-.11	-.25	-.25	.14	-.16	-.18
8						1.00	.17	-.09	-.02	-.14	-.12	-.23	-.24	.11	-.15	-.15
9							1.00	-.22	-.01	-.20	-.08	-.17	-.16	.06	-.09	-.08
10								1.00	.17	.29	.04	.23	.20	-.01	.09	.13
11									1.00	.19	.11	.08	.11	.07	.12	.14
12										1.00	.18	.32	.34	-.05	.28	.30
13											1.00	.15	.15	.12	.23	.24
14												1.00	.77	-.11	.29	.29
15													1.00	-.03	.28	.30
16														1.00	-.07	-.09
17															1.00	.77
18																1.00

Table B-6 continued

Intercorrelations of Questions 3-33

	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
3	.21	.25	.30	.31	.31	.21	.22	.25	.45	.35	.13	.12	.26	-.17	.22
4	-.15	-.17	-.11	-.14	-.17	-.08	-.04	-.08	-.21	-.18	-.03	-.03	-.14	.22	-.03
5	-.20	-.21	-.19	-.22	-.20	-.13	-.11	-.17	-.26	-.33	-.11	-.84	-.19	.18	-.15
6	.18	.24	.21	.24	.27	.29	.26	.38	.53	.55	.20	.15	.23	-.23	.29
7	-.19	-.22	-.17	-.17	-.19	-.14	-.18	-.19	-.35	-.40	-.14	-.15	-.18	.18	-.20
8	-.12	-.14	-.17	-.15	-.20	-.18	-.20	-.17	-.34	-.36	-.15	-.14	-.09	.14	-.17
9	-.08	-.10	-.07	-.09	-.02	.00	-.02	-.02	-.13	-.09	-.03	-.10	-.03	.13	.01
10	.08	.09	.03	.11	.08	.07	.11	.11	.14	.08	.10	.07	.05	-.23	-.01
11	.08	.11	.07	.08	.10	.03	.02	.05	.04	.05	-.00	.07	.11	-.14	.05
12	.29	.27	.33	.29	.28	.08	.11	.17	.19	.12	.05	.09	.21	-.16	.08
13	.19	.25	.20	.23	.19	.04	.06	.10	.09	.11	-.02	.09	.09	-.08	.05
14	.26	.27	.26	.34	.28	.10	.11	.13	.24	.15	.10	.09	.20	-.17	.10
15	.22	.25	.26	.32	.28	.15	.08	.15	.26	.16	.08	.12	.25	-.14	.13
16	-.15	-.04	-.06	-.10	-.12	.07	-.05	.06	-.07	-.08	.03	.12	.02	.00	.03
17	.66	.71	.64	.67	.64	.13	.04	.13	.26	.17	.08	.07	.22	-.18	.12
18	.75	.82	.65	.69	.67	.16	.09	.17	.31	.23	.08	.15	.24	-.17	.12
19	1.00	.77	.68	.64	.67	.16	.08	.17	.25	.18	.07	.10	.24	-.19	.13
20		1.00	.64	.69	.67	.20	.12	.20	.31	.27	.08	.13	.22	-.18	.13
21			1.00	.75	.75	.15	.13	.21	.25	.18	.10	.19	.25	-.10	.15
22				1.00	.77	.11	.16	.16	.28	.24	.11	.18	.22	-.12	.12
23					1.00	.21	.14	.19	.35	.26	.13	.18	.25	-.11	.17
24						1.00	.05	.38	.37	.30	.16	.18	.25	-.15	.38
25							1.00	.22	.33	.31	.14	.16	.14	-.10	.18
26								1.00	.40	.43	.25	.23	.28	-.17	.33
27									1.00	.60	.22	.31	.30	-.25	.40
28										1.00	.23	.23	.26	-.22	.36
29											1.00	.42	.21	-.05	.18
30												1.00	.37	-.01	.24
31													1.00	-.14	.21
32														1.00	-.16
33															1.00

VITA



