

1-1-1999

Think different: A comparison of the critical thinking abilities of education majors

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**THINK DIFFERENT: A COMPARISON
OF THE CRITICAL THINKING
ABILITIES OF EDUCATION
MAJORS**

by

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UMI Number: 9973963

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Dissertation Approval
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April 12, 2000

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Think Different: A Comparison of the Critical Thinking Abilities of
Education Majors

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ABSTRACT

Think Different: A Comparison of the Critical Thinking Abilities of Education Majors

by

Shelly Weeks Channel

**Dr. Maralee Mayberry, Examination Committee Chair
Professor of Sociology
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In an increasingly complex society, the need for people to exercise critical thinking effectively is clearly evident. The institution of education recognizes that its responsibility to teach students to think critically is vital in order for them to negotiate decisions humanely and intelligently in an ever-changing world.

Hundreds of reports from various committees and researchers along with such insidious incidents as the rise in murderous assaults on children inside school buildings, such as the massacre in Littleton, Colorado, attest to the fact that schools fail to teach students to evaluate social life critically. While educators advocate critical thinking, teacher education faculty must insure that prospective elementary teachers possess and exercise critical thinking abilities to pass on later to their students.

This was an exploratory investigation. It sought to examine the critical thinking abilities of both elementary education and secondary education majors in a local

university in a city in the Southwest. A review of the literature revealed little research that compared critical thinking abilities among prospective elementary education teachers and secondary education majors as well as among prospective teachers and typical college students having different academic backgrounds. This study identified the difference between the critical thinking skills of prospective elementary education teachers and prospective secondary education teachers (research hypothesis 2) and identified the difference in critical thinking appraisal scores between prospective elementary and secondary education teachers' scores and the scores of typical college students as measured by the Watson-Glaser Critical Thinking Appraisal (research hypothesis 1). The following research hypotheses were investigated:

1. Prospective teachers have lower critical thinking appraisal scores than typical college students as measured by the Watson-Glaser Critical Thinking Appraisal.
2. Prospective elementary education teachers differ from prospective secondary education teachers with respect to critical thinking skills.

Results of testing supported both hypotheses.

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ACKNOWLEDGMENTS

Pursuing a Ph.D. as a wife, mother, and full-time elementary school principal has been difficult. I have met this challenge with the help of God, His Highest, who continues to work successes in my life. He is my rock and my fortress.

I fully appreciate the unwavering support and encouragement of my family. I thank my husband, Gassaway, for his love, friendship, patience, and support throughout this process. Thank you, too, to my daughter, Genaye, and my son, Sean, for reminding me that love and laughter are indeed the essential aspects of life. I also wish to thank my mother, Virginia, for her prayers and constant belief in me, for she has been my greatest lifelong teacher who has constantly pushed me forward. Thanks, Mom, for teaching me to plan purposefully, prepare prayerfully, proceed positively, and pursue persistently. In addition, I am grateful to my siblings, Bethana, Daryl, Holly, Joan, Carole, and Eric, who were always present with me in thought, action, and prayer as well as my nephew, DeMarlo, for his encouraging words. Holly and her husband, James, were especially helpful in caring for my children so I could pursue this research.

I sincerely thank the members of my committee, Dr. Maralee Mayberry, Dr. Bob Parker, Dr. Donald Carns, and Dr. Porter Troutman. My chair, Dr. Mayberry, has provided assistance, encouragement, and inspiration throughout my graduate studies; she

merits a special place in my heart. Dr. Bob Parker and Dr. Marsha Kobre Anderson have contributed kindness, support, and writing expertise for this insecure writer. Dr. Porter Troutman's chronic question, "When are you going to finish your dissertation," prompted me to move along. Dr. Barbara Brents always greeted me with a warm smile and an extended helping hand. Finally, I thank Dr. David Dickens, Dr. Donald Carns, and Dr. Rodney Young for their guidance. All of them gave me their time and energy.

My friends, Joann DeBose, Joyce Best Wallace, Pearlene Lesco, Traci Davis, Lelon Walter, and Renea Dabney, deserve thanks as well. Joann engaged the fun, laughter, encouragement, support, and special friendship required of colleague-students in a doctoral program. We have both worked diligently. Joyce offered intellectual stimulation during our walks in the wee hours of the morning. Pearlene, Traci, and Lelon gave their personal support in time, attention, computer technology expertise, and encouragement, especially during the stress of the final stages of the project. Renea offered me prayers and inspiration.

Finally, I thank Dr. David Meckley, UNLV Curriculum and Instruction advisor, who so generously agreed to help me in conducting this research. To the Class of 1999 graduating education majors who participated in this study, I am forever grateful.

DEDICATION

**To my husband, Gassaway; my children, Genaye and Sean;
and my mother, "Babe":**

You believed in me when I had doubts.

**And to my father, the late Spencer Lee Weeks,
who had many dreams:**

Another one came true for me.

PREFACE

During the 1960s and 1970s, my four sisters, two brothers, and I grew up in an inner city housing project. When I was 10 years old, my family moved into a huge three-story house in a more affluent neighborhood. Our childhood guidance was provided primarily by our mother, even though we lived with both parents. All of us attended public schools.

I recollect most of my early schooling as drab--characteristic of arbitrary rules, emptiness, and sluggishness. I do not remember much of the information taught to me. My thinking was not challenged.

In the elementary years, I recall absorbing textbook information and reciting its lessons back to the teacher by rote. The teachers lectured endlessly and, as they spoke, students were expected to listen silently and/or write down their pearls of wisdom word for word. To achieve academic success, I literally memorized the thoughts of others. I was not encouraged to question what was presented as truth or belief. What a pity!

One emotionally profound incident occurred in 1963. As I sat in mean Mrs. Collier's second grade class, a loud voice boomed from the intercom proclaiming that President John F. Kennedy had been shot. The teacher gasped, and the adults in the school building frantically discussed the report. Teachers marched in and out of the classroom. Finally,

school was dismissed early. I didn't understand. I knew only that Kennedy was President of the United States. My ignorance made me afraid, and I ran all the way home. I cried as I sat in my mother's lap as she anxiously watched the news on television. I barely slept. All I could think about was that President Kennedy was shot to death.

When I returned to school, I eagerly anticipated a discussion of this earth-shaking event. After all, the airwaves were filled with President Kennedy's death, his life, his suspected murderer, the death of the suspect, and so on. I needed to speak, to let go of my own emotions and knowledge. Mrs. Collier never mentioned the incident at all. She did not challenge my classmates or me to understand and think through a national tragedy. What a pity!

I continue to reminisce. With a smile, I recall a delightfully memorable creative writing lesson. Mrs. Ginyard was one of the few elementary school teachers who offered some intellectual excitement. During a third-grade assignment on the planets and the universe, Mrs. Ginyard talked about higher level thinking and encouraged us to move our minds from one set of ideas to another. She challenged me. We had to write about "The Alien from Mars." After two pages of writing, I proudly submitted my essay, and Mrs. Ginyard chose it for public reading at the school's parents' night program. As I read the story, my self-esteem climaxed! After the final sentence, "Well, I better not tell you any more about the alien from Mars because he will come down here and get me," the audience bestowed upon me thunderous applause. Yes, me! It felt good. I felt good about thinking. She and others challenged my thinking and promoted the questioning of

what I saw, heard, or read. They had a tremendous positive impact on my ability to assimilate knowledge acquired in school and in the world. What a joy!

As I think of those early teachers like Mrs. Collier, I feel angry. Those teachers had little or no positive impact on my ability to analyze situations conceptually. I often wonder about the current unfavorable assessments of students' critical thinking. How do individuals think logically and how do they learn to do so? How important is critical thinking to how people perceive the world and succeed in life? Why didn't my own elementary school teachers focus more of their time on critical thinking skills?

More than one hundred years ago, John Stuart Mill (1862) stressed the importance of critical thinking. He believed that critical thinking keeps the mind clear and prevents people from stumbling in the dark over outrageous fallacies. Lane and Jones (1983) demonstrated that critical thinking governs rational thinking in all areas of learning and life. Further, Paul (1990), a prominent member of the critical thinking movement, reported that most educators in his research did not experience teaching that required them to develop their own critical thinking until graduate school.

Critical thinking relates to all of life's encounters; therefore, it must be taught efficaciously. Clearly, economic and political processes, labor markets, and military service in American society require citizens to be able to think critically. Are teachers like Mrs. Collier, devoid of the ability or interest in stimulating the development and growth of students' critical thinking, still somewhere within the American educational system?

According to Lipman (1991), "it is often the case that our most cherished recollections of our school years are of those moments when we thought for ourselves--not, of course, because of the educational system, but in spite of it." A new century has dawned, provoking incredible challenges. Teachers must, therefore, be effective shapers of students' critical thinking behavior. Are the teachers themselves critical thinkers? That is the central question guiding this research. A wealth of information about the ability of novice teachers to think critically can be gained from this research.

CHAPTER 1

INTRODUCTION

Focus of Inquiry

Sociologists of education focus on a variety of issues pertaining to the institution of education. One issue of concern is student achievement. Poor academic achievement scores on a variety of tests taken by American students have received frequent attention over the past two decades. In particular, the thinking ability of current American students has come into question.

Published by the National Commission on Excellence in Education (1983), A Nation at Risk was most influential in reporting the frightening statistics about academic performance, including low levels of critical thinking skills, among American students during the 1980s. For example, the National Assessment of Educational Progress (NAEP, 1981) cited the quality of thinking and organization as the critical factor in the problem of student writing, not mechanics as teachers expected. NAEP further reported that trends in academic performance, including critical thinking, have either declined or shown relative stability in the 1990s. Other reports condemned students as less knowledgeable and skilled than earlier generations and bemoaned their poor performance

in comparison to other industrialized nations (Carnegie Task Force on Teaching as a Profession, 1986; College Board, 1983; Holmes Group, 1986; Newsweek, 1988; Task Force on Education for Economic Growth, 1983; Twentieth Century Fund, 1983).

In reaction to these reports, educational reformers increased academic requirements for students during the 1980s and 1990s. Consequently, educational reform became a national priority (Campbell, Voelkl, & Donahue, 1998). In fact, critical thinking skills were identified as important foundation competencies by the Secretary's Commission on Achieving Necessary Skills (SCANS) in What Work Requires of Schools: A SCANS Report for America: 2000 (U.S. Department of Labor, 1991). Moreover, the Educational Excellence Act of 1999, the Clinton administration's commitment to ensure that all children achieve, includes the challenging standard that all students will learn to use their minds well, the definition of critical thinking, so they may be prepared for responsible citizenship, further learning, and productive employment in the modern American economy (U.S. Department of Education, 1999).

Radical reform activities have been implemented since the release of the landmark report, A Nation at Risk (1983), and nearly two decades later, the critical thinking skills of students have improved. According to the National Center for Education Statistics (1995), educational efforts to increase students' academic performance, especially the development of students' abilities to think and have a positive disposition toward thoughtfulness, have progressed with marginal success.

Chaffee (1991) declared that the American system of education is believed to produce literate and sophisticated thinkers, equipped with the knowledge and intellectual

abilities needed to be informed citizens and successes in their chosen occupations. Yet, a growing awareness is evident that many students leave school without the literacy and sophisticated thinking skills necessary for the intense responsibility and collaboration required by the future work and social order. Ennis (1985), for example, a proponent of the critical thinking movement, argued that little has been done about critical thinking even though it has been decreed a priority of education for a century. Sarason (1990) offered the reason in his book, The Predictable Failure of Educational Reform. He suggested that the needs of various groups to defend their power within the institution of education have stifled reform efforts. Another hindrance to change and improvement continues to be long-standing educational structures. For example, although legislation requires higher standards, well-established patterns of instruction, textbooks, and curriculum guidelines remain essentially the same.

As the United States rushes into the 21st century, these findings appear to demand that the American educational system institute reforms that will produce substantial, long-lasting results in improving students' critical thinking skills. Importance of and interest in critical thinking relative to the institution of education continue to emerge as an area of national significance.

The Importance of Critical Thinking

A fundamental goal of education in American society is to help students become effective thinkers. As envisioned by Paul (1986), the end product of education is the critical thinking of the inquiring mind:

A passionate drive for clarity, accuracy, and fair-mindedness, a fervor for getting to the bottom of things, to the deepest root issues, for listening sympathetically to opposite points of view, a compelling drive to seek out evidence, and intense aversion to contradiction, sloppy thinking, inconsistent application of standards, a devotion to truth as against self-interest--these are essential components of the rational person. (p. 1)

Numerous articles, books, and studies have focused on critical thinking. They stem primarily from the lack of thinking ability observed among students over the past two decades and the need for students to be able to think critically in order to meet future demands and to participate fully in a modern, democratic society. The importance of critical thinking emerges as the theme that consistently emanates from this plethora of information.

As suggested by the literature, the rapid expansion of knowledge urges educational institutions to accelerate the adoption of programs that foster critical thinking. The method for accomplishing this task relies upon the empowering of students to locate and process knowledge rather than simply to memorize facts (Adams, 1990; Burns, 1986; Costa, 1988; Leslie & Wingert, 1990; Sorenson, Buckmaster, Francis, & Knauf, 1996). Contending that to be competitive in a modern world economy, Reich (1993), for example, identified critical thinking as one of the most important skills for American workers to possess in the future.

Similarly, Leslie and Wingert (1990, p. 56) reported that employers indicate they want people who have mastered more than just the basics; they need people who know how to think. Moreover, Rose and Nicholl (1997) maintained that American workers must out-learn, out-think, and out-create their competitors in order to be successful in the

current economy. Consequently, companies must mobilize every ounce of their collective intelligence by ensuring that critical thinking is spread throughout the organization. For example, corporate critical thinking virtually deifies giant societal influences such as Einstein, Newton, Darwin, and Bill Gates, and current students are expected to learn to think like them.

The Relationship Between Critical Thinking Abilities of Teachers and Students

One key concern is the quality of teachers who are charged with the responsibility of developing critical thinking skills in students. For this reason, the U.S. Department of Education's National Education Goals 2000 included a pledge to provide current and prospective teachers with opportunities to acquire the knowledge and critical thinking skills needed to instruct and prepare all Americans for the 21st century. Moreover, a general agreement appears in the literature of the necessity for teachers to be effective critical thinkers themselves in order to be able to teach critical thinking (Johnson, 1987; Lipman, 1985; Swartz, 1987; Walsh & Paul, 1985; Wincocur, 1985).

How learning occurs in a classroom and its success largely depend upon the teacher's approach and interaction with students. For example, Costa (1981) asserted that teachers should use their abilities to engage students in critical thinking behaviors through: (a) sequencing classroom activities, (b) encouraging higher levels of thinking, (c) phrasing questions to stimulate problem solving, and (d) using non-verbal feedback to foster risk-taking rather than conformity. Is this happening?

Olson (1996) explored a prospective teacher's dilemma of becoming a "trained professional" within the context of a teacher education program. "Susan," the teacher-in-training, openly discussed several issues related to her continued dissatisfaction with the program, her professors, and herself. Specifically, she described mixed feelings about "learning to think." In recalling her own education in public schools, Susan realized that she had not learned to think for herself, even though her grades revealed that she performed well. In a conversation with Olson on this topic, Susan reported:

University teaches you to think which is a crime because shouldn't you have learned that through twelve years of school? And the knowledge that you picked up and all the facts that you memorized, but you don't remember now anyway was a real waste of time because we could have taught you how to find out the resources, how to look through them, how to think about it, how to apply a strategy that would help you and then you should be competent in pretty well any setting.

Quite often, Susan was disappointed in the time instructors allowed for thinking about the learning process. She declared,

When I have come across some course that I really connected with, they helped me to think . . . and I haven't come across a lot of profs that seem to value that. They automatically think you should know how to do that. Well, you're not being a teacher then, are you? You're transmitting all this. And what is your job and what are you supposed to be training me to do?

Moreover, Susan felt time should have been allocated for students to think about what theories might mean to them as teachers. However, Susan stated that in her education class

. . . there doesn't seem to be enough thinking going on in a lot of what I'm doing. I can go through all these activities and not even think about them. Which is what everyone in our group seems to do. Quick, get it done and talk about whatever. But I said, "What do you think would be learned by this activity?" Then I started thinking, well, if I couldn't explain what I think they're going to learn, then what would be the point? Wouldn't they just be doing a worksheet? Here's worksheet

number two. Here's worksheet number three. Oh, you're done? Do some more [laugh].

Clearly, prospective teachers develop their knowledge and thinking about the art and craft of teaching initially during their teacher education program. Their experiences throughout their training must, therefore, greatly impact their critical thinking as well as that of their future students.

The critical thinking of the teacher affects student-teacher interaction and classroom management. Wang, Haertel, and Walberg (1993) reported conclusions from various studies indicating that student-teacher interaction and classroom management are significant proximal variables that have a strong influence on school learning. Thinking teachers are perceived as taking greater responsibility for their communication, interactions, and work, and they function at increasingly sophisticated levels of performance in facilitating the effective critical thinking of their students. Further, according to French and Rhoder (1992), when teachers exhibit thinking processes, they provide students with a way of "getting inside the head" of an expert thinker. This shows students the relevance of cognitive processes and demonstrates their importance.

More than 30 years ago, George (1967) wrote about the significance of the critical thinking abilities of college students in a comparison study of science vs. non-science education student teachers. George found that science and mathematics education majors scored significantly higher on the Watson-Glaser Critical Thinking Appraisal (WGCTA) than did the other education majors. He concluded that students who study mathematics

and science education are taught to be critical thinkers. Perhaps the conclusion should be that students attracted to mathematics and science are better critical thinkers to start with.

For the present study, I contend that elementary education majors must be the best critical thinkers in order to benefit their students during their early impressionable years. If they do not have effective critical thinking skills, then how can they build a foundation for their students to be proficient critical thinkers?

Other specific conclusions abound in the literature, however. They range from the perception that the teacher is extremely important in determining the critical thinking ability of the student (Tabor, 1988) to the improvement of critical thinking among students when the teacher emphasizes these abilities (Jones, Palincsar, Ogle, & Carr, 1987). In terms of college students, Carter, Bishop, and Kravits (1998) found that the better college students think, the more effective they will be when performing on a job. It is possible, then, that a prospective teacher who neither has nor utilizes critical thinking skills will not be able to teach them effectively.

The knowledge base on critical thinking continues to grow; however, many questions remain. For instance, what are the critical thinking abilities of prospective teachers? Do prospective science teachers still demonstrate critical thinking abilities that surpass those of other education majors? How do elementary education majors fare in critical thinking skills? How do elementary education majors compare in their critical thinking abilities with non-elementary education majors?

Most of the research on critical thinking has focused on its importance and how to teach it. One challenge for researchers in this area is to expand their investigations to

include further emphasis on the critical thinking abilities of prospective teachers. This is important because the critical thinking abilities of prospective teachers comprise one vital element in understanding how teachers teach critical thinking and, subsequently, how students learn and maintain it. This study will add new data to the few existing studies, thereby helping to bridge a gap in the research on the critical thinking abilities of prospective teachers.

Problem Statement

Educators agree that improving the quality of students' critical thinking is essential if they are to live, work, and function effectively in the 21st century. Aware that students at all levels are leaving the educational system without adequate critical thinking skills required in a changing society, educators must rethink the role of critical thought in the curriculum. Specifically, education programs must decide if potential teachers, especially elementary education majors, have the critical thought processes necessary for imparting these skills to their students.

Purpose of the Study

Colleges of teacher education must concern themselves with the training of prospective teachers in the area of critical thinking. Why? Critical thinking is an important national education goal; it is fundamental if the United States is to compete in an increasingly competitive world market. The research suggests that teachers who are not critical thinkers themselves cannot teach critical thinking effectively. Particularly

problematic is the role of elementary education majors, often overlooked in this area, but who are now expected to teach very young children how to think critically. At this early point in their lives, children are ripe for this level of thought (Piaget, 1964).

The purpose of this exploratory investigation was to investigate the difference between the critical thinking skills of prospective elementary education teachers and prospective secondary education teachers (research hypothesis 2) and to identify the difference in critical thinking appraisal scores between prospective elementary and secondary education teachers' scores and the scores of typical college students as measured by the Watson-Glaser Critical Thinking Appraisal (research hypothesis 1).

Hypotheses

Two major hypotheses were proposed for this study:

1. Prospective teachers have lower critical thinking appraisal scores than typical college students as measured by the Watson-Glaser Critical Thinking Appraisal.
2. Prospective elementary education teachers differ from prospective secondary education teachers with respect to critical thinking skills.

Definitions of Terms

For the purposes of this study, key terms and their definitions are presented for consistency and clarity as follows:

Academic achievement: scholarly accomplishment in school.

Achievement: to gain or accomplish by work or effort.

Critical thinking: a thoughtful attitude when considering problems and subjects that come within the parameter of one's own experiences and accepting the general need for evidence in supporting what is asserted as true; being knowledgeable about methods of logical inquiry and reasoning--knowing the nature of valid inferences, abstractions, and generalizations in which one can logically determine the accuracy of different kinds of evidence; and demonstrating skill in employing and applying the foregoing attitude and knowledge. This study used the WGCTA to measure critical thinking. For the purpose of this study, a high level of competency in critical thinking is defined as the ability to perform correctly the composite tasks represented by the five subtests of the WGCTA.

Educational reform: dramatic alterations in the distribution and ideology of knowledge within the institution of education pertaining to something that did not previously exist and a publicly acceptable reason is given for the change.

Effective: producing a desired result.

Institution of education: a key element of social structure that is a form of organization which imparts to individuals knowledge and skills and inculcates the values and norms of the culture.

Poor academic achievement: less than adequate accomplishment in school.

Prospective teacher: potential instructors who will be charged with the responsibility of imparting knowledge and skills to students.

Teacher: one whose occupation is to instruct (systematized teaching) knowledge and skills.

Thinking: actively using one's mind (mental faculties) to generate thoughts or ideas to arrive at conclusions, decisions, and so on.

Contributions of the Study

A research study should typically demonstrate its usefulness by contributing to the literature, providing information for applicable policy arenas, and giving insight for practitioners in the field (Marshall & Rossman, 1989; Mauch & Birch, 1993). The findings of this study provide data regarding the critical thinking abilities of prospective educators whose initial formal schooling most likely began about 1983. This critical year saw the publication of A Nation at Risk, a landmark lambasting of the American institution of education. These students, then, are products of educational reform that included an explosion in the area of critical thinking.

This study makes a contribution to the literature in three important ways. First, it offers to the growing body of literature on critical thinking information about how well prospective elementary school teachers think critically. Since they will most likely impact the future education of multitudes of children, the critical thinking abilities of these prospective teachers are important to generations to come. In addition, because these prospective teachers developed their critical thinking skills during a time of educational reform that included critical thinking, the opportunity to determine what does or does not work may be evident.

Second, information about the critical thinking skills of teachers is useful to federal, state, and local policy makers in education. One affected area is curriculum into which

critical thinking is currently infused. In addition, teacher education programs will need to consider how they train teachers to learn critically and to teach critical thinking. The impact touches teachers, students, and the future.

Finally, by drawing attention to the critical thinking abilities of prospective teachers, this study provides further insight into the possible link between the critical thinking abilities of teachers and effective teaching practices. As Carlgren, Handal, and Vaage (1994) postulated about teacher thinking, this study can offer information about the character and organization of the knowledge of teachers and prospective teachers and how that can then be developed for teaching effectiveness.

Summary

In this chapter, the topic of critical thinking abilities of prospective teachers was introduced and research hypotheses were stated. In the second chapter, the relevant literature is reviewed. The following chapter delineates the methodology. The fourth chapter reports the results, and the final chapter offers conclusions and recommendations for future research.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter consists of two main sections: literary and theoretical contexts. In the part on literary context, pertinent literature on critical thinking relevant to the present study is organized into four subsections: (a) Critical thinking: A teaching essential for the 21st century, (b) Critical thinking: A 21st century imperative, (c) Elementary education and critical thinking, and (d) The critical thinking abilities of teachers. The section on theoretical context critically examines a model of teacher thinking and establishes a theoretical framework for the present study. First, critical thinking must be defined.

Defining Critical Thinking

Virtually all definitions of critical thinking capture the idea of a mental activity that is useful for cognitive tasks. In recent years, distinct accounts of critical thinking have emerged such as the careful and deliberate determination of deciding whether to accept, reject, or suspend judgment on an issue (Moore & Parker, 1994), the formation of logical inferences from a set of information (Simon & Kaplan, 1989), the development of cohesive and logical reasoning patterns (Stahl & Stahl, 1991), and the notion of critical thinking as involving creative thinking to solve problems (Thompson, 1995). According

to Halpern (1997), purposeless or unconscious activities such as daydreams, night dreams, rising from sleep in the morning, brushing teeth, and traveling the same road daily to work or school are excluded from critical thinking. Instead, critical thinking requires the individual to focus on obtaining a desired outcome as well as evaluating the process that led to that outcome. In other words, the person thinks about "how good a decision is or how well a problem has been solved" (Halpern, 1997, p. 4). In contrast, Brown (1998) contended in a complex way that critical thinking must be understood in historical and philosophical terms to be comprehended in any educationally meaningful sense.

Other definitions of critical thinking adopt discipline-specific perspectives. For example, Nickerson (1981) described the psychological perspective: critical thinking emphasizes basic abilities such as reasoning and discovering those relationships that constitute critical thinking as well as those methods and attitudes that foster effective thinking. Various modes such as verbal delineations and higher-level operations like decision-making, problem solving, and creative thinking also define critical thinking.

Watson and Glaser (1980) defined the essence of critical thinking as displaying a thoughtful attitude when considering problems and subjects that fall within the parameter of an individual's own experiences and accepting the general need for evidence in supporting what is asserted as true; being knowledgeable about methods of logical inquiry and reasoning--knowing the nature of valid inferences, abstractions, and generalizations in which one can logically determine the accuracy of different kinds of evidence; and demonstrating skill in employing and applying the foregoing attitude and knowledge.

This definition is operationalized in the Watson-Glaser Critical Thinking Appraisal (WGCTA), the predominant instrument for measuring critical thinking cited in the literature (see Bauwens & Gerhard, 1987; Brown & Cook, 1971; Ennis, 1985; Follman & Hernandez, 1968; McDonough, 1997).

Mill articulated his concept of critical thinking from the sociological perspective more than a century ago in an essay, "On Genius." In his theory, Mill embraced social life and ethics in a discussion of the internal relationship between individual freedom, democracy, and critical thinking (Mill, 1946). Brown succinctly summarized Mill's theory of critical thinking as

. . . an account of the relationship between mind and society, a sustained critique of the authoritarian mentality and of the pervasive influence of that mentality on our social institutions to the detriment of aspirations for personal freedom, justice, social and gender emancipation. (1998, p. 8)

From the philosophical point of view, Lipman (1985) described critical thinking as involving a myriad of ways of reasoning, grasping various relationships, and detecting problems. Further, Dewey (1933)--educator, philosopher, and psychologist--provided an early influential philosophical perspective in identifying what he called "reflective thinking" that could be devoted to any type of problem. In his view, reflective thinking consists of

. . . active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it tends [that] includes a concern and voluntary effort to establish belief upon a firm basis of evidence and rationality. (p. 9)

Dewey strongly believed in the integration of experience and reflection with learning content in spite of his advocating education based on the scientific method. According to

Cuban (1984), Dewey's ideas had a major impact on a reform movement known as "progressive education." In progressive education, curriculum and instructional changes were initiated to improve students' thinking skills. This school of thought stressed understanding and critical thinking rather than rote learning and blind acceptance of facts.

Nickerson et al. (1985) noted that "even with the articles and books that are focused on the teaching of thinking, one can find numerous definitions and characterizations of thinking, or, more commonly, of specific types of thinking . . . " (p. 263, p. 9). Popper (1972), with a different perspective, discouraged preoccupation with definitions and instead recommended critical discussion of entire theories which contain the terms in question.

Popper (1972) supported a logical view of critical thinking. This was also offered by Johnson (1992) who highlighted the theoretical conceptions of critical thinking among major figures within the critical thinking movement: (a) McPeck, (b) Ennis, (c) Paul, and (d) Siegel. Their accounts or depictions of critical thinking are considered to be embedded in a theory which means not only a definition, but also "the concepts, principles, arguments, and assumptions which support that definition of critical thinking, as well as the interests which fuel the theory and the broader agenda" (Johnson, 1992, p. 40). One could argue, then, that differences in the definition of critical thinking occur at the theoretical level.

The first major figure in critical thinking to consider is McPeck (1981) who defined critical thinking and rationality synonymously. According to McPeck, critical thinking is "the propensity and skills to engage in an activity with reflective skepticism" (1981, p. 8).

Critical thinking skills, he claimed, are also necessary for engagement in activities, but a set of superimposed skills cannot replace basic knowledge in a particular discipline.

Critical thinking, then, must go hand-in-hand with basic content learning that should be discipline-specific, and the critical thinking skills should also be discipline-specific in order to be fostered adequately. McPeck clarified this issue:

It is a matter of conceptual truth that thinking is always thinking about X, and the X can never be everything in general, but must always be something in particular. Thus, the claim, "I teach my students to think" is at worst false and at best misleading. To the extent that critical thinking is not about a specific subject X, it is both conceptually and practically empty. The statement "I teach critical thinking," is vacuous because there is no generalized skill properly called critical thinking. (1981, p. 4)

Ennis (1987) presented critical thinking as the main emphasis of learning. He considered an individual to be engaged in critical thinking when performing reasonable, reflective thinking in deciding what to believe or do. He urged the importance of "thinking skills"--focusing on a question, judging the credibility of a source, or deciding on an action--and "dispositions"--trying to be well-informed, being open-minded, or taking into account the total situation. In short, skills or abilities refer to know-how, while disposition is inclination to do something. Skills and dispositions are neither mutually dependent nor mutually exclusive. Consequently, Ennis proposed that teachers build thinking abilities and cultivate thinking dispositions. This proposition depends upon the interactions between the learners and the teachers. For learners to develop critical thinking skills, according to Ennis, teachers must stress and model appropriate thinking dispositions during class discussions and lectures, seek and present alternative points of view, and encourage and respect various perspectives within the classroom.

Unless this happens, dispositions towards effective critical thinking will most likely not occur regardless of the technical subject knowledge of the students.

Paul (1990) described critical thinking as "the art of thinking about your thinking while you are thinking in order to make your thinking better." It is disciplined, self-directed thinking that displays mastery of intellectual skills and abilities. He identified four types of thinking: (a) "monological," (b) "multilogical," (c) "dialogical," and (d) "dialectical." Monological thinking refers to thinking expressed from only one point of view; multilogical, from more than one. Monological problems are solved through restriction to one frame of reference. In contrast, multilogical problems require more than a single point of view, necessitating dialogical thinking--exchange among various points of view. Dialectical thinking, then, results from engagement in dialogical thinking with the goal of testing the strengths and weaknesses of opposing points of view.

Paul was also concerned with "strong sense" vs. "weak sense" critical thinking. "Strong sense" critical thinkers can question their own framework of thought, reconstruct the strong versions of various points of view opposed to their own, and reason dialectically (multilogically) to determine effectively when their own point is at its weakest and the opposing one is at its strongest. "Weak sense" critical thinking, on the other hand, is characteristic of those who have no authentic commitment to fairness or openness to truly divergent points of view. Paul therefore urged teachers to model and encourage critical thinking in the "strong sense" in the classroom so that students might divest themselves of prejudice, dogmatism, intellectual manipulation, and other forms of narrow-mindedness.

Critical thinking, according to Siegel (1988), is evident when a person "is appropriately moved by reason: she has a propensity and disposition to believe and act in accordance with reasons; she has the ability properly to assess the force of reasons in the many contexts in which reasons play a role" (p. 23). Consequently, he forged a close association among critical thinking, problem solving, and rationality.

In his essay, "Understanding Critical Thinking," Hawes (1990) offered an approach for connecting and comprehending the plethora of definitions and characterizations of critical thinking by focusing on the meanings of "critic," "critical," and "criticism." For instance, often, "critical" suggests fault-finding or conveys negativism. Accordingly, someone who finds fault or is negative is a "critic," and "criticism" involves the activity or spoken expression of fault-finding. A critic might offer a criticism by being critical of a situation. In terms of educational thinking, Hawes stressed that the critic can be perceived as one who gives a reasoned evaluation. This suggests that "criticism" and "critical" mean "characterized by reasonable evaluation of something." For example, "critical writing" exhibits the qualities of reasonable evaluation. Halpern (1997) concurred by confirming that

. . . the critical part of critical thinking, an evaluation component, can and should be a constructive reflection, conveying positive and negative attributes. When one criticizes (or evaluates), you tell whether you think something is "good" or "bad," and you may also tell if you think it is "more worthy" or "less worthy."

Based on these impressions, critical thinking must be reasonable, rational, logical, intelligent, sound, sensible evaluation that may result in many kinds of evaluation depending upon what is being evaluated, the purposes of the evaluation, and the methods

used for evaluation. The reason to attempt to combine the different kinds of thinking under one umbrella is that

... there will be found some generality of method or skill, so that in learning to think critically in one way or one area, a person will be able to do the same, or to learn to do the same, in another area. (Hawes, 1990, p. 48)

Hawes concluded by claiming that the intent is to yield a possible generality of critical thinking theory or an understanding, appreciation, or attitude if generality of skill or method is not possible.

These definitions and characterizations of critical thinking provide a background to use for the present study. In addition, they offer a framework of critical thinking theory on which to base this project. As Norris and Ennis (1989) insisted, it is necessary to have a clear, defensible notion of critical thinking in order to deal with critical thinking evaluation.

The WGCTA was developed based on the definition of critical thinking put forth by Watson and Glaser (1980). For the purpose of this study, the five subtests that comprise the WGCTA--Inference, Recognition of Assumptions, Deduction, Interpretations, Evaluation of Arguments--will be used to examine hypotheses 1 and 2.

The Relationship of Critical Thinking Definitions and Theory to Prospective Teachers

In theory, the ability of the prospective teacher to think critically is manifested in the development and improvement of clear, precise, purposeful thinking of his or her students. Using Watson and Glaser's definition of critical thinking, the educational ideal

of critical thinking, for the purpose of the present study, is expressing a thoughtful attitude when considering problems and subjects that fall within the parameters of a person's experience and accepting the general need for evidence in supporting what is asserted as true; being knowledgeable about methods of logical inquiry and reasoning--knowing the nature of valid inferences, abstractions, and generalizations in which one can logically determine the accuracy of different kinds of evidence; and demonstrating skill in employing and applying the foregoing attitude and knowledge. A detailed explanation follows.

First, critical thinking is defined as expressing a thoughtful attitude when considering problems and subjects that fall within the parameters of a person's experience and accepting the general need for evidence in supporting what is asserted as true. This suggests a willingness to engage in ways of thinking that allow a person to use previous knowledge to create new knowledge. This aids in recognizing and solving problems, formulating inferences, calculating likelihoods, and making decisions based on evidence in support of what is asserted as true within the realm of daily life. Those who form opinions and behave without a thoughtful attitude act arbitrarily and unreasonably. Critical thinking is not arbitrary; it does not lead to random conclusions. In general, critical thinking leads to the best conclusions.

Second, critical thinking is defined as being knowledgeable about methods of logical inquiry and reasoning--knowing the nature of valid inferences, abstractions, and generalizations from which one can logically determine the accuracy of different kinds of evidence. Critical thinkers, for example, must know how to infer conclusions from facts

or premises. In fact, they must recognize the necessity of supplying a premise to an argument when none is evident. In theory, a person who begins with facts and thinks critically will most likely arrive at correct conclusions by teasing out already-known information. Critical thinkers must also examine the reasonableness of their own thoughts and those of others. This does not occur by accident; a diligent effort to seek and use valid reasoning must be exercised consciously by critical thinkers.

Third, the focus of critical thinking is demonstrating skill in employing and applying the foregoing attitude and knowledge. This characteristic of a critical thinker is closely related to the previous one because it, too, suggests that critical thinking requires conscious direction. Demonstration of skill represents active accomplishment of purpose.

In summary, the definition of critical thinking that applies to this study emphasizes process. According to Norris and Ennis (1989), the process definition of critical thinking is "in harmony with the traditional goals of critical thinking instruction, which are concerned more with teaching how to think than with teaching what to think" (p. 5). Critical thinking, then, is an educational ideal based on a philosophy of education. In general, it maintains that education should foster the maximum intellectual development of an inquiring mind with a continuing desire for knowledge. In addition, it should support and encourage the greatest educational effort along with the development and expansion of students' ability to apply their intellect to solve the problems of citizenship in a democratic society.

Literary Context

Critical Thinking: A Teaching Essential for the 21st Century

Throughout the 20th century, scholars have expressed their concern about teaching students to think critically. Perkins (1992) argued that the post-A Nation At Risk (1983) era was not the first time in the 20th century that advocates of progressive education emphasized critical thinking as an important element for the future. For instance, Dewey (1910) published his seminal work discussing the need to promote thinking nearly 100 years ago, and Whitehead (1929) foreshadowed the current discussion in the following observation: "Your learning is useless to you till you have lost your texts, burnt your lecture notes, and forgotten the minutiae you have learnt by heart for the examination." In addition, the concept of critical thinking was expressed in Glaser's An Experiment in the Development of Critical Thinking (1941) and in Bloom's Taxonomy of Educational Objectives, Handbook I: Cognitive Domain (1956). These books inspired some school districts to pursue the teaching of thinking. Later, however, Venn (1964), Blauner (1964), and Maeroff (1983) elaborated on their belief in the necessity for "thoughtfulness," critical thinking, in the workplace. The corporate need spurred the educational need.

To be considered well-educated in the 21st century, students will need critical thinking as one of the most essential skills (Jones & Maloy, 1996; Marzano, 1992; Uchida, Cetion, & McKenzie, 1996). According to Siegel (1988), critical thinking

. . . promulgates the development in students of autonomy, self-sufficiency, the skills of reason assessment, and the attitudes, dispositions, habits of the mind, and

character traits of the critical spirit, and erects those features of persons as the fundamental guidelines for the evaluation and transformation of society.

Critical Thinking: A 21st Century Imperative

People equipped with skills for a rapidly changing, multicultural, technology-oriented society are scarce (Jones & Idol, 1990, p. 2). For example, in the article, "Survey Says Young Workers Lack Basic Skills," Padgett (1999) cited Jernigan, a researcher at the School-to-Careers Professional Development Center at the University of Nevada, Las Vegas, who commented on the lack of skills among students that employers want their workers to possess. Jernigan asserted, "I think people realize what we're producing as far as high school graduates being ready to go to work is not what business and industry [are] looking for."

The institution of education faces a dilemma. Historically, reading, writing, and "rithmetic" were the only requirements for basic education. Employers in a non-industrialized society wanted strong backs and minimal brains. With industrialization came increased office-type requirements that necessitated increased depth and breadth of knowledge. For the professions, basic liberal arts backgrounds served as the foundation for further learning. Today, however, in a technological age, customer service, teamwork, flexibility, adaptation, and people/mechanical skills replace traditional brains, brawn, and knowledge in the workplace. This has changed the role of the school from a provider of learning to a facilitator of learning acquisition.

People must now live and work within globally networked systems. In fact, 32 years ago, Bell (1968) anticipated the society of the year 2000. He observed that critical thinking would be essential for an information society and for dealing with the problems to be faced in the new millennium. In the present society, information is considered the basis of primary industries and, therefore, the passport to productivity, competitive strength, and economic achievement. Problems now, according to Bell, include how to "reconcile conflicting individual desires through the political mechanism rather than the market," "allow the citizenry greater participation in making decisions," "reorganize the older bureaucratic patterns of hierarchy and detailed speculation," socialize children through schools rather than families, devise methods for the "growing disjunction between the 'culture' and the social structure," and control "new densities and communications overload." By application of critical thinking, individuals can sift through and filter information.

The world is becoming smaller. Gates (1996), for example, spoke about Teledesic, a new communications technology having the capacity to transform millions of lives by bringing state-of-the-art communication and Internet services to people anywhere in the world by placing hundreds of satellites in low orbit. Clearly, the needs of the current society depend upon people who have the ability to think critically in order to absorb existing information and create new information from it. Consequently, excellence in the future will rely increasingly upon intellectual capabilities.

A decade ago, Jones and Idol (1990) forecasted the changes in American schooling from the traditional industrial/manufacturing age requiring manual labor and basic

employment skills such as punctuality and courtesy to the age of information and services necessitating critical thinking. As predicted, more and more Americans work in jobs encompassing the creating, processing, and distributing of information. The need has shifted from the "human hand" to dependence upon the "human brain." In all types of businesses, people must now utilize critical thinking as they evolve from a manufacturing mentality into the "thinking business" of intensifying competition as new information technologies are applied to old industrial tasks (Hamel & Prahalad, 1994; Minkin, 1995; Moore, 1996).

Surviving in a diverse world also requires critical thinking. According to Smith (1999), president of Union Religious College in Lincoln, Nebraska, learning to think is central to the educational experience and school is the place where students should develop those critical thinking skills necessary for a changing society. He questioned if people truly understand how important critical thinking skills are for youngsters brought up in a complex pluralistic world where they must repeatedly confront the need to distinguish continually between "the factual and the alleged, the real and the artificial, the temporal and the eternal." He argued that training young people to think for themselves is imperative in order for them to stand more firmly on spiritual ground.

Similarly, White (1903), in the early 20th century, was concerned with critical thinking. She observed, "As the student sacrifices the power to reason and judge for himself, he becomes incapable of discriminating between truth and error, and falls an easy prey to deception." According to White (1903, p. 17), ". . . it is the work of true

education . . . to train the youth to be thinkers, and not mere reflectors of other men's thought."

It is imperative that society produce students who know how to think, for they must be more than great observers. Youngsters must know how to apply the facts and skills they have already acquired, analyze and evaluate their own thinking, and, more specifically, exhibit changes in their behavior as a result of critical thinking now and in the future. Thus, the ability to think critically is an important outcome of 21st century education. As Shoenberg (1986) astutely observed,

The outcome affects not only the personal lives of the individuals and their immediate families, but the welfare of the entire society that depends on a citizenry able and willing to think complexly about complex issues and to deal with conflicting claims within a consciously understood value system.

Elementary Education and Critical Thinking

When a person is young is the best season wherein to acquire knowledge, 'tis a season when we are freest from care, the mind is then unencumbered and more capable of receiving impressions than in an advanced age--when young, the mind is like a tender twig, which you may bend as you please, but in age like a sturdy oak and hard to move.

Abigail Adams

Young children, entering formal schooling at five or six years of age, are constantly engaged in figuring out things in their world. They come to school with many prior experiences from their environment, along with the curiosity and intense desire to learn that all children possess. Elementary school, defined as grades kindergarten through five,

the first stage of a child's formal education, provides the basic foundation of education for the next decade or more of the child's education. According to Bennett (1986), elementary education is an experience of unsurpassed importance for every child. He postulated that, after the family, the elementary school is the most influential institution in a child's life because it helps shape children's first and lasting views of themselves, molds aspirations, and develops crucial life skills such as critical thinking.

The development of critical thinking at the elementary school level is the initial phase in the process of preparing young learners for a life inundated in a world of mass media where the ability to discern bias and fact manipulation becomes a vital part of effective critical thinking abilities (Barth & Mitchell, 1992). Dewey (1943) noted that the elementary-age child is already intensely active in thought and action; therefore, the question of education is to take hold of the child's activities and give him or her direction. He proposed that through the teacher's direction and organized use of their brains, children tend toward producing valuable results instead of scattering their thoughts or actions or being left merely to impulsive expression.

Carey (1996) concluded, from studies conducted with children, that, at a very early age, children begin to utilize basic concepts such as "think," "say," "mean," and "understand" to represent the thoughts and utterances of others. For example, in an experiment using a false belief task about the location of a marble, Wimmer and Perner (1983) demonstrated that children as early as age four realize for the first time that something they know to be false may be seen as true by another individual. At this age, children also begin to characterize these false beliefs using the verb "think" as in "She

thinks the marble is in the toy chest." From an early age, then, "think" is used to distinguish a belief different from that of the speaker. Accordingly, it presents a specific attitude about another person's belief. This begins the child's "critical thinking." Children are therefore able to comprehend and analyze the beliefs of others without personally accepting them.

In the elementary school, the nurturing of these critical thinking capabilities begins. As Erickson (1995, p. 22) noted, "Teachers form a nurturing chain for students as they move through the grades." Clearly, teachers want their pupils to grow in their abilities to act thoughtfully and to take on and deal effectively with the complex problems of life as they arise. In fact, the promotion of each child's capacity to think continues to be a top priority within education (Raths, Wasserman, Jonas, & Rothstein, 1986; Reaves & Griffith, 1992). Yet, Hyde and Bizar (1989) noted that most of the programs designed to teach thinking are aimed at secondary school students.

An ancient Chinese proverb states that a journey of 1,000 miles begins with the first step. Similarly, the elementary teacher, presenting reading, writing, spelling, penmanship, mathematics, social studies, and science to 25 or 30 children, initiates the first step in providing children with the most essential component of their education--the ability to think critically.

Elementary education acts as both a foundation and bridge to further education. Dewey (1943), for example, in an essay on the psychology of elementary education, viewed elementary education as the "borderland" of secondary education. He conjectured,

It comes when the child has a sufficient acquaintance of a fairly direct sort with various forms of reality and modes of activity; and when he has sufficiently mastered the methods, the tools of thought, inquiry, and activity, appropriate to various phases of experience

Tomorrow's teachers face the incredible challenge of developing the ability of their students to think critically at the turn of a new century and a new millennium when the American nation is characterized by profound demographic and behavior changes and transitions. Their students may flounder or fail when presented with tasks designed to elicit some imagination, to call for the suggestion of hypotheses, to connect means with ends, to take cognitive risks, and to expect them to extend their thinking into new, unknown territory. Today's young students have been reared on television, movies, and computers. They have been exposed to changed standards in morality and redefined ethical behavior. At the same time, the environment of school and work has moved to an information base that requires every individual to think critically. Because of the requirement for teaching critical thinking to all students, teachers must challenge themselves to think critically in their confrontation with the formidable classroom challenges of the 21st century. They will then be empowered to teach effectively.

The Critical Thinking Abilities of Teachers

Marton (1994) summarized the idea of the critical thinking of teachers. She asserted that people assume that hidden entities and processes behind what people do exist in order to understand and make sense of what individuals actually do. It is evident, according to Marton, that individuals have knowledge, memory, thoughts, feelings, a will,

motivation, the potential ability to solve problems, and the ability to render decisions or retain information without really demonstrating any sign of what really goes on. Marton asked, "Where are those invisible entities located? Where are these invisible processes taking place? Well, it must be in people's heads, obviously. What we know; what we remember; what we think about, must be in our heads as well."

A representation, or model, of the world is considered to be built through an individual's sensory organs from information gained about his or her environment. According to Marton (1994), subsequent actions such as thinking "mean an inner 'doing something' in the model world." For Marton, two worlds exist--a real world that truly exists "out there" and a replica of that world in people's heads. In research about the thinking of teachers, for instance, Marton noted that this way of understanding has been a dominant aspect of perception about thinking: the real world vs. the replica. Marton proposed that the focus on the thinking of teachers should be on understanding and, perhaps, predicting ways in which, by their own thinking, teachers impact students. This has an effect on the decisions and problem-solving of both students and teachers. According to Marton, "Teachers' acts are affected--if not caused--or controlled by their thoughts." In other words, teacher behavior is highly influenced and even determined by their own critical thinking.

The importance of the thinking of teachers is reflected in the literature. According to Jones, Tinzmann, Friedman, and Walker (1987), critical thinking of teachers is important:

When teachers model their thinking aloud, it is particularly important in teaching how to construct meaning (especially because of the nonlinear character of thinking),

teaching students how to monitor their own thinking and how to answer a question through reasoning.

In contrast, Lipman (1991) suggested, "One ought to be wary of expecting all the modeling for critical thinking from the teacher." He advocated the teacher as a model of reasoning procedures, one who transcends right or wrong answers to emphasize the process of inquiry itself rather than insist upon an answer that may be right or wrong at a specific time. "It is the behavior of such a teacher," he asserted, "that is especially cherished and relished by students, for it has an integrity they are quick to appreciate" (p. 219). Thus, his reasoning for understanding the critical thinking of teachers is different; nevertheless, Lipman supports the importance of the critical thinking abilities of teachers.

On the same topic, Olson (1997) urged, "Teachers need to talk more about what they themselves critically think and encourage students to do the same" (p. 507). He contended that when teachers implement a conscious effort to introduce and use such language about thinking in the classroom, they influence students to reflect upon and articulate their own thinking and express their own thoughts.

In 1986, a study conducted by the National Center for Education Information provided insight into why individuals choose to teach. One reason is related to teachers' thinking. According to Emily Feistritzer, NCEI director at the time, one significant reason teachers indicated they teach is for an opportunity to use their "own minds and abilities." Erickson (1995) provided a description of these "thinking teachers":

Thinking teachers work within curricular structure requirements, yet personalize the design for student learning by thinking deeply about their students, outcomes, and plans for curriculum and instruction. Moreover, these teachers think on their feet, watching for opportunities to ask provocative questions. A correct answer may not

always be as significant as the thoughtful rationale. They have a clear vision of success for students and mentally challenge themselves to draw out the best efforts.

Calfee and Shulman (1986) further observed that, in order to improve instruction effectively and demonstrate excellence in education, efforts must be made to gain understanding of how teachers think about content and how explicitly that understanding is made to students.

Critical thinking of teachers, as a research area unto itself, is relatively new. It is, according to Clark and Peterson (1986), a paradigmatic approach to research on teaching. Three fundamental assumptions underlying the research on critical thinking of teachers have emerged: (a) the thinking of teachers constitutes a large part of the psychological context of teaching; (b) within this context, curriculum is interpreted and acted upon where teachers teach and students learn; and (c) teachers' behaviors are considerably influenced and even determined by their critical thinking (Clark & Peterson, 1986, p. 255). The goal of this area of study is to describe the mental lives of teachers, to understand more fully and explain how and why observable instructional activities performed by teachers take on the forms and functions that they do, and to determine how the complexity of classroom teaching is managed by teachers. The thought process of teachers has been explained by Halkes and Olson (1984):

Looking from a teacher thinking perspective at teaching and learning, one is not so much striving for the disclosure of "the" effective teacher, but for the explanation and understanding of the teaching processes as they are. After all, it is the teacher's subjective school-related knowledge which determines for the most part what happens in the classroom; whether the teacher can articulate his/her knowledge or not. Instead of reducing the complexities of the teaching-learning situations into a few manageable research variables, one tries to find out how teachers cope with these complexities. (p. 1)

Clark and Peterson (1986, pp. 255-256) elaborated upon some of the research on the critical thinking abilities of teachers. For example, Jackson (1968) conducted a study in an attempt to describe and understand the mental constructs and processes that underlie teacher behavior. Jackson described complex issues involved in the teacher's task, formulated conceptual differences that relate to teachers' professional lives, and established an awareness of the significance between teacher thinking and a better understanding of classroom processes. For example, Jackson identified an "interactive phase" of classroom teaching, defined by Clark and Peterson (1986) as thinking accomplished by teachers during classroom interactions. Jackson (1968) postulated that "a glimpse at this 'hidden' side of teaching may increase our understanding of some of the more visible and well-known features of the [teaching] process."

Dahllof and Lundgren (1970) contributed a series of studies to the body of knowledge on the thinking of teachers. They investigated the structure of the teaching process as an indication of organizational constraints, focusing on the effects of contextual factors on teaching. Their research also led, however, to the disclosure of some of the mental categories that teachers use to organize and make sense of their classroom teaching experiences. For example, Dahllof and Lundgren designated a small group of students within the class as the "steering group," a subset of the class for teachers to use as a reference group for determining the pacing of a lesson or a unit of study. When the teacher conducted whole-group instruction and observed that the "steering group" seemed to understand the topic, a new concept was introduced. When teachers thought the "steering group" did not understand, the teacher slowed the pace of

instruction for all students. The significance of the "steering group" is twofold: (a) it has empirical verifiability and (b) it demonstrates how the thinking or mental constructs of teachers can have important pedagogical consequences. In addition, teachers intentionally or subconsciously identify "steering groups" in their classrooms to use as barometers of instruction.

In 1974, the National Institute of Education conducted a national conference on Studies in Teaching for the purpose of producing an agenda for future research. Within the 10 groups organized for creating research plans in specific areas, Panel 6 on Teaching as Clinical Information Processing related to the thinking of teachers. The group included specialists in the psychology of human information processing, the practical realities of teaching, the anthropology of education, and classroom interaction research. Their final report (National Institute of Education, 1975) delineated key elements for a proposed research program on the thinking of teachers that included a rationale, assumptions, and an argument for the necessity for research in this area.

Members of Panel 6 clearly envisioned the teacher as a practitioner. They considered the teacher a clinician who was responsible for diagnosing learning problems of students and implementing programs for rectifying those difficulties. Moreover, in a broader sense, they were oriented toward the teacher as one responsible for the aggregation and understanding of the various sources of information about students. Teachers, in theory, accomplished this task by probing and applying empirical and theoretical research within the field of education. They then synthesized the information they gathered along with their own expectations, beliefs, attitudes, and purposes. In

addition, the teacher as clinician was viewed as one involved in a continuous cycle of assessing the educational environment, implementing appropriate programs, reflecting, and regrouping to improve for excellence. Panel 6 declared:

It is obvious that what teachers do is directed in no small measure by what they think. Moreover, it will be necessary for any innovations in the context, practices, and technology of teaching to be mediated through the minds and motives of teachers. To the extent that observed or intended teacher behavior is "thoughtless," it makes no use of the human teacher's most unique attributes. In so doing, it becomes mechanical and might well be done by a machine. If, however, teaching is done and, in all likelihood, will continue to be done by human teachers, the question of the relationships between thought and action becomes crucial. (p. 1)

Research was also reported by Panel 6 on human information processing. For example, when a person is confronted with a complex situation, he or she creates a simplified model of that situation and acts upon it in a rational manner. According to Simon (1957; cited in National Institute of Education, 1975, p. 2),

... such behavior is not even approximately optimal with respect to the real world. To predict ... behavior we must understand the way in which this simplified model is constructed, and its construction will certainly be related to [one's] psychological properties as a perceiving, thinking, and learning animal.

Overall, the deliberations and the recommendations of the panelists reinforced the necessity for research on the thinking of teachers in order to comprehend fully the uniqueness of individuals in the process of teaching.

Theoretical Framework

It is important to understand the process of teaching in relation to the thinking of teachers. Consequently, the present study used Clark and Peterson's (1986) theoretical model of teacher thinking and subsequent action. Their model, shown in Figure 1,

provides a visualization of the relationship between teacher thinking and teaching effectiveness. It includes two domains: (a) Teachers' Thought Processes and (b) Teachers' Actions and their Observable Effects.

CONSTRAINTS AND OPPORTUNITIES

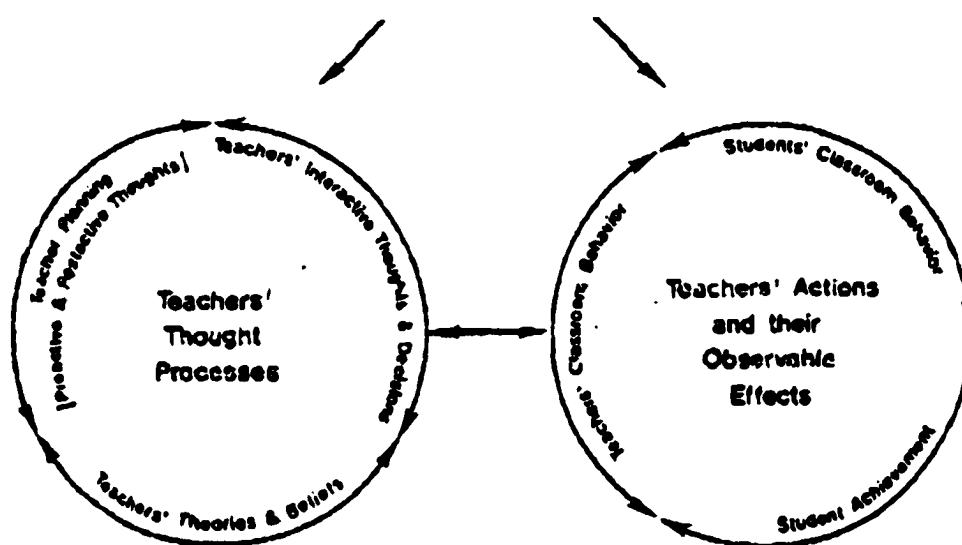


Fig. 1. A model of teacher thought and action.

The domain of Teachers' Thought Processes, thinking occurring "inside teachers' heads," encompasses three major categories: (a) teacher planning--preactive and postactive thoughts, (b) teachers' interactive thoughts and decisions, and (c) teachers' theories and beliefs. First, teacher planning includes all of the thought processes that

teachers engage in before (preactive) and after (postactive) classroom instructional interaction. These thoughts then guide their thinking and projections for future instructional interaction within the classroom.

Borko and Shavelson (1990) conceptualized teacher planning as a teaching component in which a formulation of instructional activities or actions by the teacher is carried out over periods of time such as a school year, term, week, day, or lesson. Even though most teachers produce written plans, Borko and Shavelson (1990) suggested that "a large portion of planning is mental-dialogues in which teachers engage. Much of the result of this mental planning never appears on paper" (p. 313). In general, then, teachers make use of mental scripts when teaching in addition to the activities that they have planned.

Next, the interactive thoughts and decisions of teachers involve teachers' thinking during classroom interaction. Teacher thinking and decision making differ from their thought processes. Furthermore, teachers' interactive thinking and decisions differ from planning decisions in that interactive thinking and decisions are usually made without the luxury of time to seek additional information. This interactive thinking is consequently viewed as a thinking process resulting in deliberate choice to implement a specific action. In other words, the teacher consciously chooses to behave either as before or differently.

Clark and Peterson (1986) calculated, from five studies that reported these data, the estimated number of decisions made by teachers as a result of interactive thinking. They found the number of decisions to be extremely consistent, ranging from .5 to .7 decisions per minute (see Fogarty, Wang, & Creek, 1982; Marland, 1977; Morine & Vallance,

1975; Shroyer, 1981; Wodlinger, 1980). According to Clark and Peterson (1986), these data suggest that the interactive thoughts and decision making of teachers are intensely demanding within the classroom setting, dramatically impacting upon instruction.

Notably, Clark and Peterson (1986) explored research that had distinguished among preactive, interactive, and postactive phases of teaching. They hypothesized that the kind of thinking that teachers do while involved in classroom interaction would differ qualitatively from the kinds of thinking engaged by teachers before and after instructional interaction. Finally, the abundance of knowledge stored in the minds of teachers that impacts their planning, interactive thoughts, and decision making is represented by their theories and beliefs.

In the domain of Teachers' Actions and Their Observable Effects, the actual practice of classroom teaching occurs. In the classroom, the behavior of the teacher has observable effects on students. The model in Figure 1 (Clark & Peterson 1986) indicates that the direction of causation is circular. Teacher actions and behavior affect student actions and behavior influence teacher actions and behavior and so on. The ultimate impact is upon student achievement or learning. Furthermore, the achievement of students may bring about a change in the behavior of the teacher towards the students which, again, affects student behavior, actions, and achievement. Therefore, the relationships among teacher behavior, student behavior, and student achievement are reciprocal.

The double-headed arrow depicted between the two spheres representing the two domains in the model in Figure 1 (Clark & Peterson, 1986) denotes the reciprocal

connection between the domains, Teachers' Thought Processes and Teachers' Actions and Their Observable Effects. The actions of teachers are influenced by the thinking of teachers which affects teachers' actions and so on. This model indicates that the process of teaching can be completely understood only when the two domains are brought together and are examined in relation to each other.

Finally, Clark and Peterson (1986) viewed constraints and opportunities, defined here as the extent to which responsibility and participation in the school decision-making process are given to teachers, as important variables in their model of the teaching process. Research supports this as a significant variable in the definition of effective schools as well, for constraints and opportunities can impinge upon the teaching process. For example, the physical environment or external influences such as the school administration, the required curriculum, or overbearing or disinterested parents may constrain the actions or behaviors of teachers. Possibly, teachers may exhibit certain behaviors simply because they are permitted to do so. In the same way, a teacher's thinking may be constrained. For instance, teachers may perceive that they have less flexibility in their planning due to the school district's implementation of a required curriculum framework. Conversely, teachers may feel that more flexibility and opportunity are given to them by the administration to engage in planning and decision making in spite of the curriculum requirements.

The theoretical framework of teacher thinking and action used for this study (Clark & Peterson, 1986) recognizes an important connection between the critical thinking of teachers and their manner of teaching. Most significant is the suggestion by this model

that the critical thinking of a teacher has a consequential impact on teaching behaviors and ultimately on student achievement. More specifically, a teacher exhibits critical thinking, the combination of preactive, interactive, and postactive thoughts influenced by the teacher's theories and beliefs. The teacher, then, has a teaching style, made up of teacher actions, that models and reinforces critical thinking. That is, the thinking of the teacher affects teacher behavior which affects the critical thinking behavior of students which, in turn, affects the critical thinking achievement of students. The goal is to develop in students critical thinking skills, habits, and dispositions. The critical thinking exhibited by the teacher fosters willingness among the students to subject their beliefs, theories, and actions to scrutiny as the teacher has done. The result is empowering of students to understand the justifications for their own thoughts and actions. In this way, thinking teachers develop thinking students.

Summary

In this chapter, the literature on the topic of critical thinking was reviewed. First, critical thinking was defined. The review of the literature was presented in two sections: literary and theoretical contexts. Finally, the theoretical framework to be used in the present study was shown. In the next chapter, the design of the study is presented.

CHAPTER 3

METHODOLOGY

Introduction

The methods utilized for this study are described in this chapter. Aspects of the methodology include research design, research context, participant selection, data collection, and data analysis.

Research Design

A quantitative research design was employed to test the following research hypotheses:

- 1. Prospective teachers have lower critical thinking appraisal scores than typical college students as measured by the Watson-Glaser Critical Thinking Appraisal.**
- 2. Prospective elementary education teachers differ from prospective secondary education teachers with respect to critical thinking skills.**

Research Context and Participant Selection

The study was conducted in a large comprehensive university in a heavily populated metropolitan area in the Southwest United States. Study participants consisted of an ad hoc sample of undergraduate students enrolled in the teacher education program. Seniors in their final semester in the university's education division volunteered to participate. Their majors were elementary education and various academic disciplines within the broad category of secondary education.

Approval to conduct research involving human subjects was granted by the Office of Sponsored Programs, University of Nevada, Las Vegas. The research participants were informed that their participation was completely voluntary and that they could withdraw from taking the test at any time. In addition, they were assured anonymity. They were also advised that they might benefit from the study by gaining enhanced insight into their own critical thinking relative to their prospective profession--teaching. Paperwork regarding permission to conduct human subjects research is located in Appendix A.

Data Collection

The Watson-Glaser Critical Thinking Appraisal® (WGCTA), Form A, was administered to participants during a course required for senior students. The criterion instrument consists of five subtests designed to measure different aspects of critical thinking. The number of items is 80, and the test requires approximately 40 minutes to complete. The five subtests are described in Table 1.

Table 1

Subtests of the Watson-Glaser Critical Thinking Appraisal® (WGCTA)

Test	Topic	Items	Description
1	Inference	16	Discriminating among degrees of truth or falsity of inferences drawn from given data
2	Recognition of Assumptions	16	Recognizing unstated assumptions or presuppositions in given statements or assertions
3	Deduction	16	Determining whether certain conclusions necessarily follow from information in given statements or premises
4	Interpretation	16	Weighing evidence and deciding if generalizations or conclusions based on the given data are warranted
5	Evaluation of Arguments	16	Distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular question at issue

The WGCTA is designed to provide problems and situations which require the application of some of the important abilities involved in critical thinking: (a) inference, (b) recognition of assumptions, (c) deduction, (d) interpretation, and (e) evaluation of arguments. Exercises include problems, statements, arguments, and interpretations of data similar to those that may be encountered on a daily basis in the workplace, in the newspaper, in speeches, and in discussions on a wide variety of topics. A side benefit of the test is its value as an aid in developing critical thinking.

A second questionnaire, developed by the investigator (Appendix B), gathered demographic data. It also asked participants to indicate their major, their current grade-point average, and their intent to teach.

Test Reliability

Any test used to measure the thinking of students should be reliable and valid (Baron, 1987). According to Watson and Glaser (1980, pp. 10-11), the WGCTA is a valid, reliable tool. Reliability was assessed in several ways with estimates sufficiently high to warrant its use in group administration and research.

The reliability of the WGCTA was tested first for internal consistency by calculating its split-half coefficients. Second, the stability of its test scores over time was measured. To accomplish this task, the WGCTA was administered twice with an interval of three months to a group of 96 college students. The nearly identical means and standard deviations of the first ($\underline{M} = 57.4$; $\underline{S.D.} = 8.1$) and second ($\underline{M} = 56.8$; $\underline{S.D.} = 8.4$) testing sessions reflected reasonable stability over time ($\underline{R}^2 = 0.73$). Finally, reliability of the WGCTA was determined by correlating responses of subjects on alternate forms (A and B) of the test.

Test Validity

Validity refers to the extent to which a measure provides data that relate to commonly accepted meanings of a concept. In this case, the test must relate to meanings of critical thinking. One criterion for use is the long history of the WGCTA which has known validity and has demonstrated that it is appropriate, meaningful, and useful for the inferences yielded from test scores (Babbie, 1995, pp. 127-129).

As described in Chapter 2, researchers do not agree on the definition of critical thinking. In trying to determine the content validity of the WGCTA, it became necessary

to measure a sample of specified objectives for critical thinking within instructional settings. In those environments, teachers were attempting to develop "critical thinking" abilities in their students. The content of the WGCTA was tested in various settings by test users with different needs and purposes within the contextual frame of reference of the classroom. The WGCTA was found to be valid.

Construct validity refers to what test scores mean and what kinds of inferences they support. Consequently, experience in programs designed to develop critical thinking ability should be reflected in changes in performance on the WGCTA. In the case of this test, several studies have provided evidence of the construct validity of the WGCTA (Agne & Blick, 1972; Fogg & Calia, 1967; Sherman, 1978; Sorenson, 1966).

Data Analysis

The statistical software package known as SPSS (Statistical Package for the Social Sciences) was used to help analyze the data from this study. Each hypothesis was analyzed individually.

The first hypothesis states, "Prospective teachers have lower critical thinking appraisal scores than typical college students as measured by the Watson-Glaser Critical Thinking Appraisal." In order to test this hypothesis, the scores between the two populations were examined, and a t -test was performed.

The second hypothesis states, "Prospective elementary education teachers differ from prospective secondary education teachers with respect to critical thinking skills." This

research hypothesis was tested by determining the mean scores of both elementary and secondary education majors and performing a t-test to indicate significance.

Research Design: Advantages and Limitations

Advantages

The Watson-Glaser Critical Thinking Appraisal (WGCTA) is the oldest and probably the most widely used standardized test of critical thinking (Spicer & Hanks, 1995). It offers several advantages. First, it is an efficient tool to administer to a large group of subjects. Second, the WGCTA permits the researcher the time to become thoroughly familiar with the test and its directions for administration. In addition, the test administrator can determine the venue for testing that will allow for optimum performance of participants. Third, it enables control of the testing session by the researcher. Next, the test is simple to score, and results can be generalized to a group of individuals with characteristics similar to those of the sample tested. Finally, the WGCTA offers high reliability (.70 to .82) (Spicer & Hanks, 1995, p. 4).

Limitations

The WGCTA also exhibits limitations. For example, results can determine only inferences about the critical thinking ability of students which are actually merely educated guesses. According to Spicer and Hanks (1995), some critics fault this test for its over-reliance on deductive logic and its inclusion of overly simplistic questions in the

area of inductive inference (p. 4). Another problem is the length of the test. It takes 40 minutes to administer this challenging test (Laskey & Totraitis, 1992). Moreover, test anxiety and the formality of the WGCTA testing situation may negatively influence test scores (Hanson, 1975; Marjoribanks, 1972). Finally, standardized test items sometimes reflect mainly White, middle-class group norms (Cummins, 1998), which may not be appropriate for a diverse group.

Summary

In this chapter, the methodology used in the present study was discussed. In addition, data collection, instrument validity, and data analysis were presented. Advantages and limitations of the instrument were also addressed. The results of the investigation are delineated in the next chapter.

CHAPTER 4

RESEARCH RESULTS AND ANALYSIS

Introduction

In this chapter, a discussion of the data gathered from the Questionnaire (Appendix B) and the Watson-Glaser Critical Thinking Appraisal (WGCTA) occurs. Demographic and other participant characteristics are described, and the statistical analysis is presented.

Participant Characteristics

Characteristics of the sample population were determined from responses to a questionnaire developed by the researcher (Appendix B). Participants in the study included a total of 73 graduating seniors majoring in elementary (68.5%) and secondary (31.5%) education. In terms of gender, 92.0% of elementary and 43.5% of secondary education majors were female; 8.0% elementary and 56.5% of secondary education majors were male. In total, 76.7% of the sample was female; 23.3%, male. Historically, most teachers in the United States have been female. For example, according to the National Center for Education Statistics (1997), 73.2% of public and private school teachers in the United States during the 1993-94 school year were female. This is similar

to the sample population in this study. Moreover, while such data are not currently reported at the federal level, Feistritzer (1983) found that females represent 83% of elementary school teachers and 49% of secondary level teachers.

The ethnic makeup of the students included 86.3% Caucasian, 5.4% Hispanic, 4.1% Asian/Pacific Islander, and 1.4% in each of these categories: African American, Native American, and Other. In comparison with national data (NCES, 1997) using different categories, Whites comprise 87.2% of all teachers, Blacks 6.8%, Hispanics 4.1%, Asian/Pacific Islanders 1.1%, and American Indians 0.8%. The proportion of participants in the present study who are Caucasian (86.3%) is nearly the same as the national population (87.2%).

Participants were asked to indicate their grade-point averages, their teaching plans in the 2000-2001 school year, and their intent to be teaching in five years. All but two students reported either an A or a B average, nearly all (90.4%) expect to teach in the 2000-2001 school year, and most (84.9%) plan to continue teaching for at least five years. Data from the questionnaire are summarized in Table 2. National comparative data on gender, elementary and secondary level, and ethnicity are shown in Table 3.

Findings

The ability to think critically is important, and the role of teachers in ensuring that their students possess this skill is essential. Consequently, this study examined the critical thinking ability of prospective teachers in the belief, supported by the literature on critical thinking and education reform, that the critical thinking ability of teachers greatly

Table 2

Participant Characteristics from the Questionnaire

Characteristic	Elementary Majors		Secondary Majors		Total	
	n = 50	68.5%	n = 23	31.5%	n = 73	100%
Gender:						
Male	4	8.0	13	56.5	17	23.3
Female	46	92.0	10	43.5	56	76.7
Ethnicity:						
Caucasian	43	86.0	20	87.0	63	86.3
Hispanic	2	4.0	2	8.7	4	5.4
Asian/ Pacific Islander	2	4.0	1	4.3	3	4.1
African American	1	2.0	0	0.0	1	1.4
Native American	1	2.0	0	0.0	1	1.4
Other	1	2.0	0	0.0	1	1.4
Grade Point Average:						
A (4.0) - Superior	21	42.0	10	43.5	31	42.5
B (3.0) - Above Average	29	58.0	11	47.8	40	54.8
C (2.0) - Average	0	0.0	2	8.7	2	2.7
D (1.0) - Poor	0	0.0	0	0.0	0	0.0
Plan to Teach 2000-2001:						
Yes	46	92.0	20	87.0	66	90.4
No	1	2.0	2	8.7	3	4.1
Don't Know	3	6.0	1	4.3	4	5.5
Plan to Teach in 5 Years:						
Yes	41	82.0	21	91.3	62	84.9
No	0	0.0	0	0.0	0	0.0
Don't Know	9	18.0	2	8.7	11	15.1

Table 3

National Data on Gender, Grade Level Taught, and Ethnicity of Teachers

Characteristic	N	%
Gender:		
Male	787,228	26.8
Female	2,152,431	73.2
Grade Level Taught:		
Elementary	1,552,317	52.8
Secondary	1,387,342	47.2
Ethnicity:		
White	2,564,416	87.2
Black	200,035	6.8
Hispanic	120,965	4.1
Asian/Pacific Islander	32,677	1.1
American Indian	21,566	0.8
Total	2,939,659	100.0

impacts the critical thinking ability of their students. Prior research revealed that critical thinking among students needs to improve in spite of reform efforts already aimed in that direction.

According to the review of the literature, education majors exhibit low scores on tests of critical thinking (Hudson, 1991; White, 1992). Moreover, achievement test scores of education majors, on average, are lower than those of college students majoring in other subjects, especially the arts and sciences (George, 1967; National Institute of Education, 1985). Unlike programs for prospective elementary school teachers, teacher education programs for secondary education majors generally incorporate additional courses in the arts and sciences disciplines or require a single- or double-major in a

subject area. This program difference led to the research hypotheses for the present study:

1. Prospective teachers have lower critical thinking appraisal scores than typical college students as measured by the Watson-Glaser Critical Thinking Appraisal.
2. Prospective elementary education teachers differ from prospective secondary education teachers with respect to critical thinking skills.

Hypothesis 1

Hypothesis 1 stated: Prospective teachers have lower critical thinking appraisal scores than typical college students as measured by the Watson-Glaser Critical Thinking Appraisal (WGCTA). The number of cases, mean test scores, and standard deviation for the study sample were calculated from data drawn from the WGCTA. The guide book for the WGCTA provides information on population norms. For all upper division college students, the test norm is 59.5 with a standard deviation of 8.5. The comparison of the study sample and the WGCTA norm is presented in Table 4. Table 4 illustrates that a noticeable difference is apparent between education majors and the published norm for upper division college students. A one sample t -test was conducted to determine whether the difference was statistically significant. Table 5 presents the results of that test ($t = 7.69$, $p < .001$). This t value is statistically significant; thus, hypothesis 1 is accepted: Prospective teachers have lower scores than typical college students on the WGCTA.

Table 4

Comparison of Study Population and Norm on the WGCTA

Population	Number of Cases	<u>M</u>	<u>SD</u>
Education Majors	73	51.68	8.69
Upper Division College Students (norm)	212	59.50	8.50

Table 5

One Sample t-Test of Results on the WGCTA

Variable	<u>N</u>	<u>M</u>	<u>SD</u>	<u>SE</u>	<u>M diff.</u>	<u>t</u>	<u>df</u>	<u>1-tail sig.</u>
Total	73	51.68	8.69	1.017	7.82	7.69	72	.000
Test value for upper division college students (norm) = 59.5								

Hypothesis 2

Hypothesis 2 stated: Prospective elementary education teachers differ from prospective secondary education teachers with respect to critical thinking skills. The number of cases, mean test scores, and standard deviations for the study population were calculated from the WGCTA data. These values were also calculated for subtests of the WGCTA. Table 6 illustrates the means and standard deviations on the WGCTA for elementary and secondary education majors. Table 7 shows the results of a t-test for the equality of the means ($t = 1.65$, $p = .052$). While the difference between the means is

real, the statistical significance is borderline at the $p < .05$ level. Table 8 depicts differences between the elementary and secondary education majors on the subsections of the WGCTA. The sections on Inference, Interpretation, and Evaluation of Arguments appear to be the primary contributors to the differences in the means, although no statistical significance appeared (Table 9).

Table 6

Comparison of Elementary and Secondary Education Majors on the WGCTA

Population	Number of Cases	<u>M</u>	<u>SD</u>
Secondary Education Majors	50	50.56	8.899
Elementary Education Majors	23	54.13	7.835
Mean Difference = 3.57			

Table 7

t-Test for Equality of the Means for the Two Samples on the WGCTA

Mean Difference	<u>t</u>	df	1-tail significance
3.57	1.65	71	.052

Table 8

Scores on Subsections of the WGCTA for Elementary and Secondary Education Majors

Subsection	Major	
	Elementary Education	Secondary Education
Inference	8.0	9.1
Recognition of Assumptions	11.5	11.4
Deduction	9.9	9.8
Interpretation	10.9	12.2
Evaluation of Arguments	10.3	11.6

Table 9

T-Tests for WGCTA Subsections

Subsection	Group	Mean	SD	t	df	1-tail sig.
Inference	Elementary	7.98	2.503	-1.75	71	.332
	Secondary	9.13	2.833			
Recognition of Assumptions	Elementary	11.50	3.072	0.14	71	.258
	Secondary	11.39	3.100			
Deduction	Elementary	9.90	2.416	0.12	71	.219
	Secondary	9.83	2.807			
Interpretation	Elementary	10.90	2.735	-1.96	71	.168
	Secondary	12.17	2.208			
Evaluation of Arguments	Elementary	10.28	2.829	-2.02	71	.107
	Secondary	11.61	2.039			

Summary

The 1-tailed t-tests were used in the analysis of the data to reflect directionality of the results. Hypothesis 1 stated that the norms would be higher than the sample values, and hypothesis 2 stated that the scores of secondary education majors would be higher than those of elementary education majors. Hypothesis 1 was accepted at .05 alpha error tolerance, and hypothesis 2 fell just outside statistical significance. An increase in the number of participants who were secondary education majors--only 31.5% of the total sample--might alter the significance of the results. A comparison of scores on the subsections of the WGCTA suggests the need for greater instruction for elementary education majors in the areas of Inference, Interpretation, and Evaluation of Arguments.

CHAPTER 5

DISCUSSION AND IMPLICATIONS: THINK DIFFERENT

Introduction

The results of this study suggest that elementary education majors lack the critical thinking abilities of typical college students and secondary education majors. At the same time, educators agree that improving the quality of students' critical thinking is essential if they are to live, work, and function effectively in the 21st century. If they are to have the critical thought processes necessary for imparting these skills to their students, prospective elementary school teachers must be taught how to think critically. In the area of critical thinking, then, educational reform can contribute solidly to the future.

Education Reform Since 1983 in Relation to Critical Thinking

The 1980s were characteristic of a constant drumbeat of criticism of the educational process within American public schools (Lipman, 1991, p. 101). The publication of A Nation at Risk in 1983 sounded a call to arms for public education and unleashed a firestorm of reform activity that continues today (Koppich & Guthie, 1993). According to Koppich and Guthie (1993), the first "wave" of reform, defined as one set of state

education policy enactments followed by another, consisted of budget alterations to the existing educational structures for changes ranging from lengthening the school day and year to establishing a mentor teacher program (pp. 55-57).

Included in the education reform of the 1980s was critical thinking (Glaser, 1985), although it often appeared as simply more content. For example, Kirst (1988) reported that first-stage educational reform activities consisted of an increase in high school graduation requirements emphasizing more mathematics, science, history, and foreign language. The content of academic courses, however, became more rigorous, focusing more on critical thinking and less on rote memorization. Koppich and Guthie (1993) asserted that initial reform efforts essentially mandated nothing truly different, but rather stressed more tests, greater academic rigor, increased classroom time, and more numerous teacher certification requirements. They stated that educational reformers "did not prompt a rethinking of the structure of schools, a re-examination of the traditional roles of school personnel, or a review of the conventional methods of delivering instruction." Senator Edward Kennedy (1993) supported this contention in "The Nation Is at Even Greater Risk Now." He argued that even though efforts were made to improve education, the response to A Nation at Risk did not result in any significant systematic or systemic changes within the institution of education.

The second wave of reform was spawned by reports launched in 1986 such as Tomorrow's Teachers (Holmes Group, 1986) and A Nation Prepared: Teachers for the 21st Century (Carnegie Task Force on Teaching as a Profession, 1986). These highly publicized publications alerted the nation to a need for re-evaluation of the American

educational system and revision to initial educational reform efforts to improve the quality of instruction in order to enhance the economic competitiveness of the United States. These reports advocated methods of instruction that would enable students to become producers of knowledge, able to think critically in manipulating information instead of merely absorbing facts. The American institution of education was therefore challenged to change its underlying organizational structures in a variety of ways such as re-examining academic course content and re-evaluating decision-making structures. Still, the nation's schools did not rise to meet this challenge.

Wasserman (1989) argued that despite the efforts of the waves of reform to ameliorate low levels of critical thinking among students, little substantial change occurred. Problems included the continued use of instructional materials emphasizing correct answers, teacher-dominated classrooms as opposed to student-centered or student-teacher interactive ones, suppression of the independent thinking of students, predominantly information recall questions by teachers, and inadequately trained teachers who were unable to bring innovation into the classroom.

Another obstacle to progress in developing and enhancing critical thinking in students was cited by Benderson (1990) who suggested that teachers are confused about what "teaching thinking" actually means. He attributed this to a rift that divides experts in the field:

Both philosophers and psychologists have come to view the teaching of thinking as their own special skill, but their perspectives are intrinsically different. . . . Philosophers stress the need for "critical thinking," while psychologists prefer the term "thinking skills" In these variations on a theme, the philosophers stress logic and objective reasoning as the core of critical thinking. The psychologists take

a different tack, focusing on the process of thinking itself. . . . Philosophers are basically interested in the exercise of logic and reason as tools to elucidate certain fundamental truths. . . . The programs they recommend for the schools emphasize the development of rational thinking as a tool for making moral and ethical decisions. . . . Psychologists, on the other hand, are concerned with the thinking process, and, with respect to education, how that process develops as children grow. . . . Problem solving is emphasized rather than logic.

Similarly, Beyer (1987) identified the lack of consensus in what constitutes critical thinking and a vagueness in its definition as obstacles to improving the teaching and learning of thinking critically. Brown (1986) concurred, stating that the insufficiency of good teaching in this area may be a result of the lack of agreement on what skills to teach.

The literature mentioned other shortcomings of education reform in creating true thinkers. For example, Duffy (1994) described why the current teacher-training model produces limited thinking development in teachers; it creates teacher technicians who, in turn, produce student technicians. He contended that teacher educators do not intentionally set out to "train" teachers as technicians; instead, they seek to achieve the goal of prescribing teacher behaviors and actions that "work" in order to simplify teaching.

Duffy recognized that conscientious teacher educators have utilized different forms of mastery learning and research results on teaching to improve the quality of their own teaching and that of their students over the past 30 years. Consequently, they reasoned that teachers would be effective in the classroom if they followed directives created by experts. Unfortunately, Duffy reported, ". . . we taught them to be compliant . . . by message." For example, to develop critical thinking, teachers were led to follow precisely prescriptions that were embedded into commercially produced instructional materials,

such as the use of workbook pages to complete critical thinking exercises. Duffy argued, however, that the problem in the lack of thinking development is not in the instructional materials themselves, but it is rather in ". . . a pervasive psychology of teacher education and the mental model it causes teachers to build for themselves" (p. 7) in following them. This psychology assumes that ordinary teachers must be directed because it is difficult for them to manage the complexity of classroom teaching. Accordingly, a variety of "directors" exists for formulating decisions for how teachers should teach. For instance, master developers write instructional materials, policymakers mandate practices for teachers, researchers provide lists of "what works" in the classroom, school administrators enforce program compliance using evaluation methods that require specified procedures, and teacher educators along with staff developers elevate and encourage preferred theories, techniques, and programs instead of independent professional thinking. These "directors" have encouraged teachers to embrace the notion of "directors lead, teachers follow." Duffy further proclaimed that change in teacher education has not been seen in recent years because "the current psychology of teacher development, where authorities prescribe for teachers, is designed to constrain teachers, not emancipate them" (p. 6). Other research has cited exceptions to this notion, but "there is no evidence that these exceptions represent a groundswell of change" (see Edelsky, 1990; Elmore & McLaughlin, 1988; McCaslin & Good, 1992).

Lipman (1991) pointed out that viewing the teacher as the sole source of the lack of critical thinking among students is unrealistic due to the "universality of the refusal to be self-critical" (pp. 180-181). In other words, the powerful "elite" who control teacher-

education bureaucracies such as state departments of education and teacher education departments in colleges and universities do not hold themselves to the same rules and procedures others are held accountable for, and they have an inability to be self-critical.

He commented:

Little wonder, then, that the thinking in universities is not much different from the thinking in the societies to which they belong, or that the thinking in schools of education is not much different from the thinking in the universities to which they belong. It is simply unrealistic of us to expect that the beleaguered faculties in schools of education are suddenly going to rise up against the system in which they have participated all these years and begin to turn out teachers who are adept at encouraging higher-order thinking.

Martz (1992) contended that resistance to change is perpetually evident, and ideas for improvement inevitably cannot or will not be accepted by teachers and administrators. Nevertheless, education reform efforts have continued. For instance, former President Bush (1992) exclaimed, "If we want to change the country, we have got to change the schools." A short time later, Congress passed and President Clinton signed a legislative act in 1994 offering nearly \$5 billion in grants through 1999 for districts to implement efforts to reform educational systems (Sorenson et al., 1996, pp. 4-5). School reform, a 20-year-old bandwagon, includes critical thinking for teachers and their students.

Thoughtful Teachers: Implications for the New Millennium

Implications for Elementary and Secondary Teachers

Critical thinking as a force in the curriculum is influenced by society, government, economics, and educators. It presents an urgent need in the 21st century--survival for a

new world order perhaps. Yet even now, in the year 2000, the results of the present study suggest that prospective teachers who expect to enter the education workforce this year need to improve their own critical thinking skills.

According to Nickerson (1989), "Individuals who do not think critically, reflectively, effectively are not likely to be able to teach others to do so." Consequently, teachers must be builders of a supportive classroom environment, demonstrating the ability to manage a climate of inquiry and engage the minds of learners in meaningful ways. For example, Gardner (1991) argued that children's notions of how the world operates are not extended, challenged, or examined in schools. Instead, children are taught textbook information considered by teachers important for them. Similarly, Barbour (1988) found that teachers do not provide a model of thinking themselves when they routinely follow plans in prepackaged programs that focus on steps and outcomes rather than on process.

The thinking teacher bases critical thinking decisions on student needs regarding approaches or programs to implement, assesses students' levels of thinking, analyzes curricular requirements, observes classroom interactions, and extends thinking through a wide range of classroom experiences. "Practitioner thinking in action is required in which on-the-spot alterations of plans are necessitated" (Kincheloe, 1993). Regardless of what prepackaged critical thinking programs are employed, the thinking teacher makes use of pedagogical strategies and other knowledge to engage a system of meaning that enables him or her to make judgements regarding what constitutes a desired outcome.

The implications of the results of the present study are clear: it is necessary to improve the teaching of critical thinking in K-12 classrooms. Particular attention to

critical thinking instructional innovations must be fostered especially at the elementary school level because this is the point of initiation of critical thinking skills. In the elementary school classroom, critical thinking skills can be nurtured and cultivated. In secondary schools, these abilities can be further fostered and honed. By the time an individual reaches higher education institutions, his or her critical thinking skills can be fully utilized and further enhanced. As Goodman pointed out, elementary schools have been places "where curricular practices and issues often amount to little more than calls for more critical thinking among students" (1992, p. 158). It is imperative, then, for all students to experience classrooms led by teachers who are concerned about promoting critical thinking through more effective classroom instruction. Provisions for developing students' critical thinking ability must be made a permanent, integral, enforced part of teaching.

Approaches to Teaching Critical Thinking

An examination of the literature on teaching critical thinking revealed that attention has been given to this important area through the emergence of a plethora of teaching ideas and programs that encourage critical thinking in any type of classroom. These ideas are worthy of discussion, and a few are presented in this section. According to Goodman (1992), "it is equally important to see how intentions can be manifested in given situations" (p. 161). In other words, suggested curricular practices are worthless unless the promotion of critical thinking in the classroom actually occurs.

Many approaches to teaching critical thinking apply to both elementary and secondary schools. For example, Spiegel (1990) highlighted a familiar instructional strategy called "dialog." It appears repeatedly in the area of thinking instruction and is considered extremely effective. In this methodology, teachers lead groups of students in discussions in which they actively and productively participate. From a constructivist perspective, Jones and Maloy (1996) commented on the many positive aspects of dialogs. For instance, dialogs are essential for discussing socially shared knowledge. As information is transmitted and critical thinking competencies are developed through dialog, knowledge becomes embedded in social structures and relationships with more ideas and beliefs. Students' familiar contexts or their discourse dictates meanings of words, numbers, and images which then convey their thoughts. In turn, these thoughts of the students offer insight into practical, puzzling, or unchallenged information which can serve as a springboard for additional dialog that invokes the critical thinking of the students.

The use of dialogs as a means of teaching critical thinking is currently prevalent in schools. Dialogs appear in various forms such as reading circles and daily oral math sessions. Within the dynamic of the dialog, classroom roles determine the perceptions by students of questions asked by teachers, the manner in which the students answer their teachers, and which cues are used by students to assist them in developing an answer. Students most often employ symbols such as signs, rules, and notations in their everyday interactions. These symbols rely on social consensus and influence how the students interpret events; therefore, the students cannot discover these symbols in isolation. The

use of multiple dialogs offers teachers opportunities to help students develop their critical thinking by exploring various dynamics and outcomes within the classroom and curriculum context.

Learning logs offer another technique for improving the critical thinking ability of students. Available in a variety of recording strategies and formats, learning logs enable teachers to gain valuable insight into the thinking processes of their students. In the learning log, students are invited to record their "thoughts and knowledge about the process and content of their learning" (Wilson, 1993). The learning log promotes critical thinking by helping learners to clarify their thinking, make judgments, and explore their personal reactions to learning. This dialog is internal and is prompted and converted to written form through entries at times determined by teachers and/or students.

Specifically, students identify, analyze, and reflect upon the processes they utilized in their learning experiences. Teachers can then read about each child's perceived needs, strengths, and challenges. Consequently, appropriate responses can be given for improvement and enhancement of thinking ability on an individual basis. In the case of learning logs, the modeling by teachers of critical thinking is not enough. To illustrate, Fishman (1998) stated,

... although my teachers wanted me to become an active learner, their demonstrating critical thinking was not by itself going to do the trick. Their approach was, "Watch me analyze. Now you analyze." ... I could only exercise critical thinking when I was encouraged and motivated to generate my own analytic work. (p. 82)

This focus on dialogs and learning logs derives from the passion of the researcher to communicate to teachers the urgency and significance of implementing strategies to use

language, verbalization, and communication with other individuals to develop and enhance critical thinking ability. As Tiedt et al. (1989) noted, "For most children language is the vehicle through which thinking occurs" (p. 4). Teachers may inquire, "Talk to me. Tell me what you're thinking." As Vygotsky (1962) acknowledged, language is not simply what one thinks about, but it is part of the thinking process itself.

Dialogs and learning logs are potentially more powerful techniques than teachers probably realize in promoting critical thinking. Many teachers already use them, but other teachers may want to consider using them more intensively to explore their effectiveness in developing critical thinking. According to Beyer (1987), "Deliberate, sustained, conscious effort on the part of teachers" (p. 8) is vital in using any strategy or technique. Teachers make it work. Through the use of these two techniques--dialogs and learning logs--teachers have a powerful tool to improve the critical thinking of their students.

Wright (1988) described a program originally developed for implementation as part of Venezuela's Project Intelligence called "Odyssey: A Curriculum for Thinking." This eclectic program, designed to reflect the multi-faceted nature of intellectual performance, consists of six teacher's manuals and books: (a) Foundations of Reasoning, (b) Understanding Language, (c) Verbal Reasoning, (d) Problem Solving, (e) Decision Making, and (f) Inventive Thinking. Within these books, approximately 100 lessons are organized according to five areas: (a) rationale, (b) reason for lesson, (c) objectives--intended purposes, (d) target abilities, and (e) classroom procedure. Minimal school in-service training is required for effective presentation. The goal of the program is for

elementary through middle-school students to enhance their critical thinking ability by performing a broad range of tasks that are considered to be intellectually demanding. Tasks include "careful observation and classification, deductive and inductive reasoning, the precise use of language, the inferential use of information in memory, hypothesis generation and testing, problem solving, inventiveness and creativity, and decision making" (Wright, 1988, p. 224).

In Venezuela's program, teachers guide students through the application of strategies in completing lessons that focus on an increase in students' abilities to utilize their present knowledge to complete their lessons. These lessons provide opportunities for students to acquire knowledge, including subject content. When students apply these strategies in given problem situations, "internalizing the mental structures and assuring transfer of the formal, abstract procedures" (Wright, 1988, p. 224) is the crucial learning that students will then apply to challenges both inside and outside the classroom. Classroom procedures encouraged within this program include strategies for teaching divergent, convergent, synthetic, analytic, inductive, and deductive thinking--components of critical thinking.

Computers offer a recent innovative approach for the development and enhancement of critical thinking. Moersch (1998) reported that many teachers now use computers as tools for supporting the critical thinking of students as well as for stressing their use of complex thinking strategies.

Computers generate many ideas for examining thinking. VanLehn, Jones, and Chi (1991) constructed computer models simulating problem-solving differences by

individuals considered to be experts and novices. Theoretically, when questions are posed to experts regarding how they solve problems, they can usually clearly and intelligently explain what they do, showing knowledge of effective and efficient self-regulation. In contrast, novices find it difficult to articulate or describe what they do to solve a particular problem. The computer modeled task knowledge, offering some rules specifying what to do in response to certain situations and others geared to stimulate self-explanation. The model was further designed to switch off given rules to allow students the opportunity to generate their own critical thinking to solve problems without the support of rules or task knowledge.

Experts in the field offer many reasons that computers might foster critical thinking (see Papert, 1980;Sizer, 1990). In relation to the present study, teachers might consider computer technology as a means for promoting greater and long-lasting thinking ability. Computers are advantageous because they lend themselves to individualized instruction, interact with students free of biases, and extend themselves to the degree needed to suit the learning task. The down side of computers concerns their lack of availability to all, increasing the height of the playing field for the technologically disadvantaged.

In deciding which critical thinking programs to choose and implement, Nickerson et al. (1985) asserted:

On balance, the results of research most directly related to thinking . . . are supportive of the view that the teaching of thinking is a legitimate and reasonable educational objective. The literature does not provide clear and incontrovertible prescriptions regarding how the teaching should be done.

Therein lies the art and the craft of teaching.

Recommendations

Teachers must "think different" regarding the role, strategies, and techniques to use in the process of teaching critical thinking. These might include:

- Teachers should view their role not as a transferor of information, prepared to deliver necessary knowledge readily packaged, but as a mediator and facilitator who interacts with students as they move through the thinking process. The teacher serves as the link between skills, strategies, and content as students engage in the thinking process.
- Teachers should apply the same critical thinking they plan to teach their students to the creative implementation of classroom lessons on critical thinking.
- Teachers must create a classroom climate for thinking by listening to students, demonstrating appreciation for individuality and openness, encouraging open discussion, promoting active learning, accepting students' ideas, allowing time to think, nurturing students' confidence in their critical thinking ability, providing feedback that facilitates further learning, and acknowledging the value of the ideas of their students. Onosko (1992) postulated, "Teachers who reflect about their own practices, value thinking, and emphasize depth over breadth of coverage tend to have classrooms with a measurable climate of thoughtfulness" (p. 40).
- Teachers must assess the development of critical thinking ability of students on an ongoing basis by utilizing indicators of growth in the acquisition and employment of critical thinking abilities. For example, one quantitative indicator may include

comparing students' performance on critical thinking standardized tests used for classroom practice. Qualitatively, teachers might observe and document student behavior and responses that demonstrate flexible thinking, problem posing, and problem solving. Portfolios of student work provide records of change in the process of thinking and in the development of product.

- One way to show critical thinking is through the use of multiple voices: primary sources, student writing, first-person narratives, literature by women and people of color, video recordings, and cultural artifacts to foster dialog about class, race, and gender.
- Teachers might consider identifying critical thinking goals and strategies that have local, state, and national funding support.
- In some states, networks of teacher support groups offer suggestions and ideas for promoting critical thinking of students.
- Beck and Dole (1992) addressed the issue of overcoming the tenacity of original knowledge. In this context, original knowledge refers to the content of textbooks. Discussing that content critically with students enables them to balance the truth of facts presented to them, thereby fostering critical thinking.
- Critical thinking is not limited to the brightest or gifted and talented students; therefore, all students should be included in the teacher's efforts to increase critical thinking ability.

Channel (2000) gathered a range of strategies for improving students' critical thinking from teachers at an elementary school in a large metropolitan area. Some examples are:

- The teacher should constantly build on prior knowledge in order for students to link new information.
- The teacher should conduct frequent oral checks for comprehension during instruction time, being sure to go beyond literal interpretation. For example, the teacher should ask, "Why," "What else," "Why did you give me that answer," and "What do you think?"
- The teacher should give students plenty of opportunity to apply knowledge and skills to new situations by giving example situations and by asking students how they might apply new information.
- A posted "Thought for the Day" is one way to enforce and enhance critical thinking skills.
- Permitting students to correct their own papers and to evaluate conclusions at the end of a lesson assists in critical thinking.
- A way of fostering critical thinking is to compare similarities and differences during a lesson, to determine what information is relevant, or to figure out if too little or too much information is presented.
- Encouraging students to differentiate between fact and opinion supports critical thinking.

- In social studies classes, teachers encourage critical thinking through recognition of different value systems among societies.
- Teachers might assign a homework task entitled, "What I Learned in School Today." Students are asked to recall and reflect upon, in a one-page essay, everything they remember about the school day.
- Teachers in all subjects must ask the students to supply, justify, and explain how they arrived at an answer.
- In some cases, the teacher might consider supplying the students with strategies for problem solving. The students must then select a strategy, explain the reason for that choice, and present the solution to the problem using that strategy.
- The use of hands-on activities individually and in groups supports critical thinking.
- Journals, another form of learning logs, provides students the opportunity to express their opinions and convey their thoughts about what they have learned or read.

As a part of this project (Channel, 2000), a kindergarten teacher expressed how she incorporates the development of critical thinking into her classroom lessons:

Thinking skills instruction is deeply imbedded in my instructional program. I work as a facilitator and coach in the classroom using such techniques as sufficient wait time for student response, active listening, and acceptance by me and the other students that errors are a natural part of the learning process. In addition, questioning strategies are used to encourage further thought and investigation.

I believe that critical thinking is enhanced by making teaching material relevant to my students' real lives. As a result, all of my curriculum is derived from the lives of five year-olds. For instance, our phonics instruction includes words generated by the children. Many of the phonics workbooks include words entirely unfamiliar to a kindergarten child, such as "yak." Although an occasional child might be able to identify a yak, most of them have no idea what that is. And although I can teach them what a yak is, there is a better way. Instead, they come up with words meaningful to them such as "yo-yo" or some Pokemon name that starts with the "y"

sound but poses problems for me in the spelling. After we have generated these word lists, we use them as a part of our daily writing.

The math program also integrates critical thinking skills. Once again, listening, wait time, and accepting errors are crucial to creating a climate conducive to learning and critical thinking skills. Making the curriculum relevant is essential. When studying shapes, we search the classroom, school, and home for things we know and we determine what shape it is. We are expanding on our prior knowledge by taking that thing we know as a door and now calling it a rectangle. Higher order thinking skills are used when the children look at a graph and tell me what information they can get from it. I don't tell them that more kids like red than green. They tell me. And they also tell me that not very many kids like black or that the same number of kids like yellow and purple. They are thinkers.

Critical thinking is the most important thing I teach in my classroom because if they can think, they can figure the rest out--with a little help from you-know-who.

In another case, music teachers responded about promoting critical thinking during music instruction:

- In analyzing voice projection, the teacher and the students listen for loud and soft sounds and think of other opposites. They then find appropriate soft or loud sounds to fit situations, such as a mouse creeping in the house or a police siren in the distance.
- When teacher and students analyze the sounds of instruments, they discover how many ways they can make sounds on various instruments. They also discover long and short, high and low, and distinctive sounds and discuss why some instruments can make only certain sounds. Critical thinking is also applied in differentiating among metal, wood, skin, and string instruments.
- Music classes are filled with opportunities for critical thinking. For example, students must listen closely and apply what they already know to analyze the melodic contour of songs. The teacher is able to lead their thinking in comparing and

contrasting variations in the form of the music, in looking at cause and effect in how dynamics and tempo changes affect the interpretation and performance of music, and in analyzing the impact of history on cultural aspects of music.

In the case of all these different classroom situations, one principle lies behind learning to think--the powers of thought are developed through the actions and practices which produce and characterize them (Mason & Washington, 1992, p. 111). In this new millennium, perhaps "thinking" teachers will play a leading role in the increased improvement of the ability of students to think critically.

Implications for Teacher Education Programs

The findings of this study suggest a need for increasing the critical thinking abilities of prospective teachers. Consequently, this implies importance for college and university teacher education programs.

Developing students who are powerful critical thinkers requires thoughtful teachers who themselves exhibit critical thinking. It is therefore imperative that teacher education programs assign critical thinking for prospective teachers the top priority in their programs. Scholars have already offered an array of ideas for developing and encouraging critical thinking in education. For instance, Tiedt, Howard, Carlson, and Oda-Watanabe (1989) described an idea for improving teacher training. They suggested including teacher thinking as part of the undergraduate teacher preparation program. To empower teachers to think and to stimulate the thinking of their students, they advocated an effort to ensure that the four undergraduate years are reserved for a major in a content

area with courses in an academic discipline that model thinking processes. For all prospective teachers, instruction in pedagogy would begin in a fifth year. This would enrich the current model of a major in elementary education and provide prospective teachers the foundation of a knowledge-based framework that would increase their ability to think critically. Many studies support this concept of fostering critical thinking in the "context of mastering subject matter knowledge" (see Csapo, 1999). Many colleges of teacher education have already adopted such a model or offer prospective teachers who majored in a subject field the opportunity to earn a teaching credential by completing a fifth year or master's program (M. K. Anderson, personal communication, March 31, 2000).

After conducting extensive field work, Duffy (1994) argued for an abandonment of the notion that the solution to teaching thinking effectively can simply be presented to teachers before they are in the context of teaching. He favors a psychology of teacher development whereby teachers view themselves as thinkers. In essence, he suggests that teacher preparation programs implement courses promoting teachers' critical thinking relative to the content and methodology expected of the curriculum to be taught as well as how they think about their work. Duffy further advocates providing opportunities within college classrooms for nurturing teachers' judgments in the context of particular situations. For example, role-playing in real-life hypothetical situations can be planned in which teachers must act out critical thinking tasks or teaching strategies. These vignettes might reflect honoring interventions, orchestrating interactions, creating authentic learning tasks, integrating learning tasks for effective thinking, interpreting instructional

activities, modifying instructional activities to achieve intended thinking goals, and "hook[ing] students on the beauty of ideas as well as the practicality of being mindful" (Duffy, 1994, p. 8).

Intellectual communities can be implemented in field experience seminars and sessions for staff development. This concept offers an opportunity for separate or joint gatherings of student teachers, professors, or staff developers to engage in dialog about such items as field experiences, curriculum, and teaching methods in which critical thinking may occur. The value of intellectual communities of this type lies in the chance for prospective teachers to have a voice and to make decisions about how to adapt a variety of possible actions to specific characteristics of the classroom. These groups validate "forms of reasoning embedded in teachers' professional actions" (Duffy, 1994, p. 17). Intellectual communities also allow professors and staff developers to collaborate on a number of topics such as student learning and methods of fostering higher level thinking.

Clark (1995) proposed another method for strengthening teacher education programs. He suggested focusing on teacher thinking research which documents findings of teachers' implicit theories and students' preconceptions along with their implications for those responsible for teacher preparation programs. For example, teachers' implicit theories about themselves and their work are viewed as significantly impacting the daily judgements and interpretations teachers make. These implicit theories are found to be "eclectic aggregations of cause-effect propositions from many sources, rules of thumb, generalizations drawn from personal experience, beliefs, values, biases and prejudices"

(p. 114). On the other hand, students maintain their preconceptions about the world, even after having been taught scientifically accurate explanations. Consequently, perception, interpretation, and judgment are affected by teachers' implicit theories and students' preconceptions, thereby affecting what teachers and students say and do.

Within the context of teacher education programs, these preconceptions and implicit theories provide information that can stimulate potentially useful questions about ways thoughtful teacher educators can assist their students, prospective teachers, become critical thinkers. Clark (1995) suggested that teacher educators ask and pursue answers to questions about the thinking of their students and reflect upon their own answers to the same questions. For instance, teacher educators may ask:

1. What are the preconceptions about teaching and learning held by our students?
2. How should we take account of what our students know and believe as we help them prepare to be teachers?
3. How might we structure field observations early in a teacher preparation program to make visible important aspects of teaching not usually obvious to primary school or high school students?
4. What do prospective teachers believe about the integration of subject matter knowledge with pedagogical skills, and what does our preparation program offer to support or challenge and replace these preconceptions?
5. What do we as teacher educators believe about teaching and learning, individually and as a group?
6. How consistent are our espoused beliefs with our methods of teaching and evaluation (that is, do we practice what we preach)?
7. Are the implicit and explicit theories of teacher educators who supervise practice teaching likely to dominate and wash out what has been taught earlier in a teacher preparation program?

8. How does variability in implicit theories among supervisors of practice teaching influence and bias their judgments and evaluations of our students? (p. 116)

According to Clark (1995), asking these kinds of questions has led many teacher educators into systematic study of their own practices and has guided their efforts to help prospective teachers foster a capacity to reflect critically upon their own practices to improve teaching (see Niemeyer & Moon, 1986; Rust, 1986).

A final suggestion, taken from Keefe (1992), is for colleges and universities to develop a program for training critical thinking specialists, much like reading specialists in schools today. These individuals would serve as a resource to teachers, assisting them in identifying students who need help in the area of critical thinking. These specialists would work one-on-one with students for skill assessment and remediation. While some may argue that it might be more helpful for the critical thinking specialist to enter classrooms to teach critical thinking as a separate subject, critical thinking is a skill that relies upon content. A thematic approach used by the teacher in consultation with the specialist or with one or two lessons taught by the specialist may prove valuable in integrating major issues into particular content areas.

Generally, the challenge for educators is to re-examine the relationships between K-12 public schools and institutions of higher education. These entities can not stand alone. They must deepen their connection in order to coordinate and promote critical thinking. Articulation of a kindergarten-through-college strategy for teaching critical thinking skills could then cooperatively be formulated and implemented.

Policy Implications

As Senator Edward Kennedy (1993) stated, "There are no silver bullets that will magically solve all problems [in the American educational system]" (p. 23). However, a course of fundamental steps can create a basis for a critical thinking improvement agenda for students and their teachers when cooperatively implemented at local, state, and federal levels. The following suggestions may assist policymakers who wish to improve the critical thinking of students and their teachers:

- Policymakers must ensure that critical thinking procedures for curriculum, instructional practices, and assessment are aligned and consistent within school districts. A variety of assessment instruments should be utilized for measuring critical thinking objectives stated in the curriculum and reflected in instructional materials. Assessment results should be used by school districts to increase the quality of children's thinking and learning.
- Policymakers must embrace an alternative view of educational institutions as democratic public spheres relative to critical thinking. They should promote this belief. As Giroux (1988) suggested:

Instead of defining schools as extensions of the workplace or as frontline institutions in the battle of international markets and foreign competition, schools as democratic public spheres are constructed around forms of critical inquiry that dignify meaningful dialogue and human agency. Students learn the discourse of public association and social responsibility. Such a discourse seeks to recapture the idea of critical democracy as a social movement that supports individual freedom and social justice. Moreover, viewing schools as democratic public spheres provides a rationale for defending them along with progressive forms of pedagogy and teacher work as essential institutions and practices in the performance of an important public service. Schools are now defended in a political language as institutions that provide the ideological and

material conditions necessary to educate a citizenry in the dynamics of critical literacy and civic courage, and these constitute the basis for functioning as active citizens in a democratic society. (p. xxxii)

- **Policymakers must invest in children early. They must adopt goals to begin enforcing the teaching of critical thinking nationwide in all elementary schools. Students who do not capture the essence of critical thinking in their early schooling may never catch up to their better prepared peers.**
- **Policymakers must give the development of students' critical thinking ability a top priority at the local, state, and federal levels of government and include it in specific high priority objectives. Educators and politicians are aware that critical thinking is essential for students, but they must manifest that awareness into dollars for implementation.**
- **Policymakers must ensure that funding from all levels of government is allocated to invest in the critical thinking preparation of teachers and administrators. Institutions of higher education must plan, develop, and offer opportunities for teachers and administrators to learn what theory and research say about critical thinking and how to correlate this information with what is known about good teaching practices and learning theory.**
- **At the local level, policymakers must ensure that directives are forwarded to school principals to communicate in various ways a clear idea of critical thinking expectations for the school. Policymakers must also provide the means for school principals to be able to mandate teachers' professional development in the area of critical thinking.**

- Policymakers must ensure that measures are taken to implement strategies to bring education technology to a high level equal to military, space, and industrial technology in order to strengthen resources for improving critical thinking. The "digital divide" could be addressed in the form of funds allocated to poor families for the purchase of computers.
- Policymakers must systematically review and revise university policies to promote better collaboration between K-12 and university staff regarding the enhancement of students' critical thinking.
- Policymakers must revise state laws and regulations for more school-based experience for prospective teachers, specifically focusing on the development of students' critical thinking.
- American business leaders should lobby for legislation impacting education reform related to the development of students' critical thinking ability, even if it is not directly economically beneficial to them. They will ultimately benefit in the form of higher quality employees.
- Policymakers must invite typical teachers and administrators to legislative chambers to present their critical thinking perspectives on matters of educational importance with the assurance that their voices will be heard and ultimately impact what happens in schools in reference to the improvement of students' critical thinking.

Kincheloe (1993) contended that education is a political process. Whether decisions are made about infusing critical thinking into a nationally developed curriculum or what

information to include in the critical thinking curriculum, questions of power arise. He commented,

The tacit rules that define what can and cannot be said, who speaks and who must listen, and whose constructions of reality are valid and scientific and whose are unlearned and unimportant--will always reflect political relationships in the society, in the classroom. (p. 39)

Perhaps the relationships resulting from widespread promotion of critical thinking will lead to policies that will enhance critical thinking for both students and teachers.

Suggestions for Future Research

The findings of this study have implications for teachers, principals, school districts, teacher educators, and policymakers as they all strive to improve the critical thinking of students in the new millennium. Other issues raised by this research regarding the critical thinking ability of teachers and students are presented for subsequent research in this field. They include:

- How is critical thinking taught in K-12 schools?
- How is critical thinking taught to prospective teachers in institutions of higher education?
- How is critical thinking being taught to college students in different academic disciplines?
- What is being taught as critical thinking in K-12 schools?--in college-level programs?

- **What current policies at the local, state, and federal levels of government impact the development of critical thinking of students?**
- **What are students' impressions of critical thinking and how are students encouraged to use critical thinking in their daily lives?**
- **What are teachers' approaches to students' critical thinking development in schools today?**

The results of this study may foster a better awareness of and subsequent action aimed at increasing levels of critical thinking in students and prospective teachers as well as prompt others to conduct research in this area. As Halpern (1997) stated, "You are what and how you think. Be sure to act on your thoughts and to use them to advance yourself and to improve even a small corner of the world. Think well and with great wisdom. The future depends on it" (p. 261). Think different!

APPENDIX A
HUMAN SUBJECTS RESEARCH
DOCUMENTATION

DATE: September 1, 1999

TO: Shelly W. Channel
Department of Sociology
M/S 5033

FROM: *for* Dr. William E. Schulze, Director
Office of Sponsored Programs (X1357)

RE: Status of Human Subject Protocol Entitled:
"Think Different: A Comparison of the Critical
Thinking Abilities of Education Majors"

OSP #115s0999-088e

The protocol for the project referenced above has been reviewed by the Office of Sponsored Programs and it has been determined that it meets the criteria for exemption from full review by the UNLV human subjects Institutional Review Board. This protocol is approved for a period of one year from the date of this notification and work on the project may proceed.

Should the use of human subjects described in this protocol continue beyond a year from the date of this notification, it will be necessary to request an extension.

If you have any questions regarding this information, please contact Marsha Green in the Office of Sponsored Programs at 895-1357.

cc: M. Mayberry (SOC-5033)
OSP File

Office of Sponsored Programs
4505 Maryland Parkway • Box 451037 • Las Vegas, Nevada 89154-1037
(702) 895-1357 • FAX (702) 895-4242

Dear Participant:

I am currently a doctoral candidate in the Department of Sociology at the University of Nevada, Las Vegas. I am working on a research project pertaining to critical thinking. The purpose of this exploratory investigation is to determine whether elementary school majors differ from secondary school majors in critical thinking ability and whether both elementary and secondary education majors differ significantly as a group, with respect to critical thinking ability from typical college students.

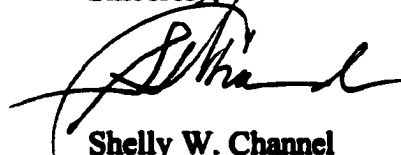
I have obtained permission from the University of Nevada, Las Vegas to do the study. I hope you will assist me in obtaining information for the project. I plan to administer to college students the Watson-Glaser Critical Thinking Appraisal in one of the university classes and need your assistance in taking this 40 minute test.

Your name and university will not be identified in my study. Instead, I will use a coding process to label and identify my data. To assure your privacy, under no circumstances will I reveal the identity of the participants to university personnel or to the public.

I deeply appreciate your cooperation and support. Without your cooperation, I would not be able to conduct this research project which hopefully will add general knowledge to the field of education and enhance critical thinking programs for education practitioners.

If you have any questions regarding your rights as a research subject, call the Office of Sponsored Programs, University of Nevada, Las Vegas at 895-1357. Questions pertaining to the research project should be directed to me (799-4777) or Dr. Maralee Mayberry, Chairperson, Department of Sociology, University of Nevada, Las Vegas (895-3322).

Sincerely,



**Shelly W. Channel
Doctoral Student**

**Department of Sociology
4505 Maryland Parkway • Box 455033 • Las Vegas, Nevada 89154-5033
(702) 895-3322 • FAX (702) 895-4800**

APPENDIX B
QUESTIONNAIRE

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