A COMPARISON OF THE SCAFFOLDING APPROACH AND THE COGNITIVE ENRICHMENT ADVANTAGE APPROACH IN ENHANCING CRITICAL THINKING SKILLS IN FIRST-YEAR UNIVERSITY FRESHMAN

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

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May 2004

To the Graduate Council:

I am submitting herewith a dissertation written by Vernon J. Hurte entitled "A Comparison of the Scaffolding Approach and the Cognitive Enrichment Advantage Approach in Enhancing Critical Thinking Skills in First-Year University Freshman." I have examined the final paper copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

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DEDICATION

I dedicate this work to my loving and supportive wife, Regenea, who has stayed this course along side me. Thank you for being you! I also dedicate this work to all of the students whose paths I will cross in the years to come. With God's help, I will make a difference in the lives of the thinkers of the future!

ACKNOWLEDGMENTS

I'd like to take this opportunity to acknowledge many individuals who have been instrumental in helping me complete this research study. First of all, I want to thank my Lord and Savior, for without Him, I would be nothing! I also want to thank my friend and mentor, Dr. Katherine H. Greenberg, who has played a major role in my growth and maturity as a scholar. I also want to thank my other doctoral committee members, Drs. Ralph Brockett, Kathleen Davis, and Sky Huck, all of which have influenced me in very positive and different ways. I'd also like to thank Dr. Trena Paulus and Mike O'Neil for their analytical guidance during this project.

I would like to thank my many colleagues, especially those in the Applied Educational Psychology Doctoral Program, who have played key roles in the completion of this study. I wish you all much success and happiness as you find your place and purpose in this world we live in. To Becky Bledsoe and Betsy Johnson, you will never know how much students appreciate not only your assistance in university matters, but your care and encouragement that help us take the necessary steps toward success!

A special thanks to the Bowie State University family, especially Drs. Cheryl H. Blackman, Jesse H. Ingram, Mary H. McManus, M. Sammye Miller, Renee H. Shea, and Patricia L. Westerman, for your continued support and encouragement throughout my journey in higher education!

Thank you to the Minority Student Affairs staff for your support during the last two years, and for helping me find those gifts and abilities that were previously hidden.

To my friend and mentor, Anton Reece, thanks for helping me realize the importance and responsibilities that comes with being a *conscious brother*.

To my family, I thank you for your love, prayers, and support since January 13, 1979. I pray that I have and will be as much of a blessing to you as you have been to me. To the late Robert "Pete" and Ethna Ford Hurte, thank you for living lives of meaning that set the foundation for the lives of generations to come. To my brothers, Keenon and Shawn, I pray that the completion of this work motivates and inspires you to carry out those things that God has planned for you. Remember as Herman Cain tells us, *you find your purpose when the gifts and talents that God has given you intersects with human need!*

Last and certainly not least, to my lovely wife, Regenea, a great scholar in her own right! Know that you are loved and adored by many, but nobody loves, adores, and appreciates you more that I do. We came together with lots of love for one another and potential for greatness, and I look forward to growing together more in love each day, and realizing the greatness that God has in store for us!

ABSTRACT

Critical thinking has received much attention in the literature in recent years. Although there is no universally accepted operational definition of critical thinking, there is agreement that it can be improved through various means of instruction. The purpose of this study was to explore the effectiveness of a modified, condensed version of the Cognitive Enrichment Advantage (CEA) approach and the Scaffolding approach in enhancing critical thinking skills in first-year university freshman.

A modified pre-test/post-test comparison group design was employed in this study. Participants were students enrolled in a freshman seminar course for first-year freshman in a merit-based scholarship program for African American students. The first phase, the Pre-Intervention Phase, included the first of three critical thinking assessment administration sessions to obtain baseline data of all participants' critical thinking ability. This phase also included a two-week period of direct instruction of critical thinking knowledge to all participants. After the pre-intervention phase, matched pairs were randomly assigned to the CEA group and the Scaffolding group, based on scores from the Watson-Glaser Critical Thinking Appraisal (W-GCTA) obtained during the second assessment administration session.

The Intervention Phase included five weekly, 40-minute teaching sessions for both groups. During the intervention period, both groups completed practice worksheets, providing a step-by-step expert strategy for critical thinking. In the Scaffolding intervention, participants also received pre-determined verbal prompts and cues to

support their critical thinking. In the modified CEA intervention, participants were encouraged to create their own personal strategies, based on the metastrategic knowledge (Building Blocks of Thinking & Tools of Learning) introduced during each session. Participants were also encouraged to provide both self-evaluation and evaluation on the contributions of their colleagues. Finally, in the modified CEA intervention, participants developed decontexualized principles for using the Building Blocks and Tools in other settings, encouraging transfer of learning. The Post-Intervention Phase included the final assessment administration session.

Results indicate no significant change in critical thinking performance in the CEA group, based on both assessment tools. Results, based on the critical thinking performance assessments, indicated no significant change in the Scaffolding group; however, results, based on the W-GCTA, indicated a significant decrease in critical thinking performance in the Scaffolding group. It was concluded that the modified CEA intervention supported the retention of the participants' critical thinking skills and facilitated learning transfer, while the Scaffolding intervention did not positively influence the participants' critical thinking skills. Recommendations for future research and issues related to conducting intervention research are offered.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure **Page**

CHAPTER ONE:

INTRODUCTION

"Critical thinking skills have become a major issue in contemporary education because they appear to hold so much promise for the individuals and society of the future" (Fleming, Garcia, & Morning, 1995, p. 437). Beyond gaining knowledge in various fields of study, another goal of participation in academic discourse is one's growth as a thinker. Often in observing many students, one would wonder whether the latter goal is being accomplished on college and university campuses. Within recent years, researchers have begun to further explore the development of critical thinking skills, particularly in college students, since a great number of students of college and university campuses are deficient in this area (Fleming, Garcia, & Morning, 1995; McMillan, 1987). In order for students to become better critical thinkers, they must develop expert thinking skills and efficiency at choosing the best skills for any particular circumstance (Hanley, 1995).

Statement of the Problem

Critical thinking skills are important to academic success on the college/university level (Steward & Al-Abdulla, 1989; Williams & Worth, 2001). As Pintrich (2002) notes, "In our work with college students, we are continually surprised at the number of students who come to college having very little metacognitive knowledge; knowledge about different strategies, different cognitive tasks, and, particularly, accurate knowledge about themselves" (p. 223). Many professional members of the university community

worldwide have probably found this same dilemma in their own practice. The importance of critical thinking has been noted in the literature, yet surprisingly, few studies have explored which teaching methods are most effective in enhancing critical thinking, particularly in adult students (Gadzella & Masten, 1998). This is due to the notion that the idea of teaching students to improve their abilities as critical thinkers "represents a major change in the way the teaching and learning process is viewed" (Halpern, 1998, p. 450). As Halpern notes, critical thinkers actually evaluate the outcomes of their thought processes, their learning. Until recently, teaching was merely seen as the transmission of knowledge; however, research has opened the door to explore the role of teaching in the development of the ability to think. The question now seems to be: what teaching approaches would make a positive difference in these students' level of critical thinking, and in turn, their academic success?

Rationale

This study compared the effectiveness of a Scaffolding approach and a modified, condensed version of the Cognitive Enrichment Advantage (CEA) approach in enhancing critical thinking skills in first-year university freshman. Although numerous studies have explored various teaching approaches for improving critical thinking, this study has a number of major differences from previous studies. First, unlike other studies that have compared a specific approach or intervention to a control group, this study compared two different approaches for improving learners' critical thinking. Second, this study's approach to Scaffolding is a much more rigid form of this approach than used in previous research studies in order to ensure a higher level of treatment integrity in the Scaffolding

intervention. Although other studies have described their interventions as scaffolding, they usually include methods that go beyond an actual scaffolding approach. Third, one intervention explored in this study, the modified CEA approach, is a more student-centered approach, which is much different from the teacher-focused interventions explored in most other studies. In these studies, participants were taught specific strategies and expected to use only those strategies, whereas in the modified CEA approach, participants were taught a specific strategy, but only as a springboard for creating their own personal strategies for critical thinking. Finally, this study explored learning transfer in the CEA group, since this approach has a major focus on facilitating transfer of learning. Previous studies have only explored the effectiveness of their respective methods in the study's setting, and not its transfer to other situations.

There are a few major differences between the two approaches explored in the present study. One criticism of the scaffolding approach is its minimal support for transfer of learning, which is a strength for the modified CEA approach. This is not to say that transfer of learning is impossible through scaffolding, but instead that scaffolding is usually too domain-specific to enhance transfer (Singley, 1995). For example, when a teacher uses scaffolding in a mathematics lesson, the likelihood of the scaffolding prompts and cues for that lesson being effective in a social studies lesson is low due to the fact that the prompts and cues would be too specific to the process of solving a mathematics problem. At best, transfer may be possible in lessons of related context; however, the likelihood is still minimal because the approach lacks the focus on enhancing transfer (Singley, 1995). Through the development of bridging principles in the modified CEA approach, which will be explained in the next chapter, the facilitator

guides learners in reflecting on how they can use their personal critical thinking strategies in a wide range of decision-making situations.

Thayer-Bacon (2000) suggests that most current perspectives on critical thinking ignore the affective aspect of the thinking and decision making process. One major difference between the CEA approach and the Scaffolding approach is CEA's focus on both the cognitive and affective aspects of learning through what Greenberg (2000b) calls the "Building Blocks of Thinking" and "Tools of Learning." Through assisting learners in developing their own personal critical thinking strategies using these Building Blocks and Tools, students can focus on a more holistic approach to the critical thinking process.

The approaches examined in this study are different, they both, however, focus on breaking down the thinking process. For the Scaffolding approach, this is done through pairing question prompts with an expert strategy for critical thinking. In the case of this study, a critical thinking practice worksheet outlined the steps for critical thinking. On the other hand, the modified version of the Cognitive Enrichment Advantage approach used in this study pairs this expert strategy with metastrategic knowledge, by way of the Building Blocks and Tools, to assist the learner in developing personal strategies for critically thinking within a situation.

Another major difference between the Scaffolding and the CEA approaches is the role of the instructor/facilitator. With the Scaffolding approach, the instructor is considered to be the individual responsible for providing appropriate knowledge and assistance to the learner. According to Vygotsky (1978), learners should be guided by a "more capable peer" to solve a problem or carry out a task that would be beyond what they could accomplish independently (p. 86). For Scaffolding, the facilitator is the giver

of knowledge, and provides information before inquiries can be made by the learner. In CEA, the facilitator assists learners in creating their own knowledge and understanding. In other words, the facilitator elicits information from the learner, creating the need for the learner to connect with the learning process and find personal meaning within the learning experience.

Greenberg (2000b) notes, "teacher-mediators find what is significant to learners and use this to fuel the interaction" (p. 38). Personal meaning makes the learning experience more personally relevant, and this energizes the opportunity for greater awareness and success. In CEA, it is important for facilitators to share their own personal interest and affective connection to the learning experience within each lesson. This allows learners to see how personally relevant the learning experience is to the teacher, at the same time serving as a catalyst for learners to share their own personal meaning. In Scaffolding, gaining awareness of the personal meaning for the learner is not an important aspect of the learning experience. As mentioned earlier, the facilitator is the giver of knowledge in this approach. What is considered important to the learner is not considered as critical to the success of the learning experience. All of these differences noted are important to the learning experience, but the final major difference may be deemed by some as the most important difference mentioned thus far: the learning evaluation process.

Unlike the Scaffolding approach, every member of the CEA classroom plays an important role in the process of evaluating learning. For Scaffolding, the instructor is the keeper of knowledge, and thus, the member of the community responsible for evaluating whether learning is taking place. In CEA, every member of the learning community

shares that responsibility. Every learner is provided the opportunity, by the facilitator, for both self-evaluation and evaluation of contributions made by other members of the learning community. This allows for broader understanding of various viewpoints, and also facilitates the opportunity for all learners to become further engaged in the learning experience.

While the scaffolding approach has been presented as a viable method for improving the critical thinking skills of learners in some studies (Ge & Land, 2003; Saye & Brush, 2002), other studies have suggested that scaffolding alone is not an effective method for increasing critical thinking (Rojas-Drummond, Mercer, & Dabrowski, 2001; Henningsen & Stein, 1997). Although the present study is the first to explore the use of this modified CEA approach in improving critical thinking skills in adult learners, past studies have explored the use of CEA with both adult learners and children. Campbell (2000) investigated its utility in teaching literacy skills to student inmates in Canadian prison schools, and found that inmates who had taken anger management, and who had experienced literacy classes using the CEA approach had significantly fewer major and minor charges than those inmates in the comparison group who had taken only anger management. Campbell also found that offenders in classes using the CEA approach suggested positive benefits from their experiences, including providing a greater understanding of how they learn best.

Greenberg (2000a) explored the effectiveness of the approach in facilitating achievement changes, based on National Curve Equivalency (NCE) scores, among White and African-American students from high poverty families. The results found that "students from classrooms where the approach was fully implemented made greater gains

overall than comparison groups on national norms, gains in National Curve Equivalency (NCE) scores, and significant decreases in the percentage of students scoring below average on standardized achievement tests" (p. 65). By comparing the effectiveness of these two approaches, more knowledge can be gained about the use of the Scaffolding approach in enhancing critical thinking, while possibly presenting the Cognitive Enrichment Advantage approach as a viable option for achieving this worthy goal.

Design Summary

A modified pre-test/post-test comparison group design was employed in this study. Participants in this study were students enrolled in a freshman seminar course for first-year freshman students in a merit-based scholarship program for African American students designed to provide important academic and social survival skills through necessary for success in a university setting. Developing positive relationships with roommates and professors, study habits, and effective management were among the topics covered in the course. This study included three phases: (1) Pre-Intervention Phase, (2) Intervention Phase, and (3) Post-Intervention Phase. The Pre-Intervention Phase included the first of three critical thinking assessment administration sessions to obtain baseline data of all participants' critical thinking ability. Two instruments for measuring critical thinking were used in this study. The first was the Watson-Glaser Critical Thinking Appraisal (W-GCTA), and the second were critical thinking performance assessment exercises, which included in each administration scenarios representing historical and employment-related situations. This phase also included a two-week direct instruction period in order to provide basic critical thinking knowledge

for all participants to control for baseline differences in the participants' knowledge about critical thinking. After the pre-intervention phase, matched pairs were randomly assigned to the CEA group and the Scaffolding group, based on scores from the W-GCTA obtained during the second assessment administration session. The Intervention Phase included five weekly, 40-minute teaching sessions for both groups. The Post-Intervention Phase included the final assessment administration session.

Research Questions

The following research questions were explored in this study:

1.) Is there a significant difference in critical thinking after direct instruction of the components of critical thinking to all participants, based on baseline and pre-intervention scores from critical thinking performance assessments administered?

2.) Are there significant differences in critical thinking between university freshman randomly assigned to class sessions where the modified CEA approach was used with one group, and the Scaffolding approach was used with another group, based on pre- and post-intervention scores from the Watson-Glaser Critical Thinking Appraisal (W-GCTA) and critical thinking performance assessments?

3.) Are there significant differences in critical thinking, based on pre- and post-intervention scores from the W-GCTA and critical thinking performance assessments, within the CEA group?

4.) Are there significant differences in critical thinking, based on pre- and post-intervention scores from the W-GCTA and critical thinking performance assessments, within the Scaffolding group?

5.) Based on reflective journal entries, to what extent do the participants in the CEA group indicate transfer of learning to other courses?

Study Limitations

There are four major limitations for this study: (1) time, (2) diffusion of treatment, (3) the researcher's role as instructor, and (4) absence of a control group. Although there has been evidence provided in previous studies regarding the effectiveness of short-term cognitive education interventions (Machleit, 1999), the length of this intervention should be noted as a possible limitation. Since the participants in this study were enrolled in a one-semester course, the study had to be limited to the 16-week timeframe of the semester. The intervention phase in this study was limited to five weekly, 40-minute sessions. Diffusion of treatment is another major limitation of this study. In order to combat this problem, students were encouraged to refrain from discussing class sessions with members of the other group. Nevertheless, it must be noted that the interventions explored in this study were very complex, and would be nearly impossible for students to be able to effectively mediate knowledge to their colleagues in the other group. The third major limitation in this study is the researcher's role as the instructor in this study. In order to combat this problem, a treatment integrity checklist was developed, and two independent observers attended teaching sessions for each group. One

observer attended each of the seven class sessions, while another observer attended three out of the seven sessions. By completing checklists during each class session, observers were able document a high level of treatment integrity. A percent of agreement is provided in Chapter 3. The final major limitation of this study is the absence of a control group. Due to logistical problems, a control group was not available for this study.

Significance of the Study

Critical thinking skills are strong predictors of academic performance (Steward & Al-Abdulla, 1989; Williams et al., 2003; Williams & Worth, 2001). Since research has established that there is a strong relationship between critical thinking and academic performance, the question becomes: How can we facilitate improvement of critical thinking in the classroom? Many classroom teachers would probably agree that the current culture of schools does not encourage a clear focus on enhancing students' critical thinking skills, especially with the current emphasis preparing students to take on standardized tests. Many institutions, especially in higher education, have established courses designed to teach critical thinking skills. However, most program curriculums cannot support such a course, so the alternative is to find approaches to improving critical thinking that can be embedded in our current course curriculums. This study seeks to explore two approaches that meet this need.

Both the Scaffolding and the modified CEA approach explored in this study are approaches designed to be embedded within any curriculum. They also both have features that support the critical thinking process. The Scaffolding approach provides

support through prompts and cues. The modified CEA approach provides learners the opportunity to develop their own thinking strategies through the use of metastrategic knowledge, while also facilitating transfer of this knowledge and strategies to a variety of critical thinking situations. This study can help meet the need for finding teaching approaches that support learning, while also supporting the enhancement of critical thinking skills in students.

CHAPTER TWO:

REVIEW OF RELEVANT LITERATURE

What is Critical Thinking?

The effort to define critical thinking has received much attention; however, no consensus has been reached in regards to this concept's meaning (Bruning, Schraw, & Ronning, 1995; Garrison, 1991). Throughout the years, many definitions of critical thinking have been offered in the literature. John Dewey suggested one of the first definitions of critical thinking. As noted by Worth (2001), Dewey described critical thinking as involving a feeling of imbalance which spurs the act of searching for information and knowledge which will create the opposing feeling of balance. In the 1960s, Dressel moved from Dewey's dispositional paradigm to a hypothetico-deductive process. Dressel (1960) suggested that critical thinking involves five steps: (1) recognizing and defining a problem; (2) clarifying the problem by collecting necessary facts or information and recognizing assumptions being made; (3) formulating possible explanations; (4) selecting one or more possible hypotheses for testing and verification; and (5) making final conclusions. This definition provided the theoretical foundation for the Watson-Glaser Critical Thinking Appraisal (W-GCTA).

Although Watson and Glaser (1964) used Dressel's (1960) definition as the theoretical starting point for developing their instrument, they also reached back to Dewey's contribution and included characteristics of disposition and cognitive skills. According to Watson and Glaser (1980), critical thinking includes "(1) attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance

of the general need for evidence in support of what is asserted to be true; (2) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined; and (3) skills in employing and applying the above attitudes and knowledge" (p. 1). Watson and Glaser's definition and instrument for measuring critical thinking is the oldest and one of the most widely used instruments measuring critical thinking in research literature today (Williams & Worth, 2001).

Since Dressel, Watson, and Glaser's work in the 1960s, another wave of definitions of critical thinking have been presented in the literature. According to Facione (1986), critical thinking emphasizes "the ability to properly construct and evaluate arguments" (p. 222). Ennis (1989) defined critical thinking as "reasonable reflective thinking that is focused on deciding what to believe or do" (p. 10). Perkins (1987) simply defined critical thinking as better thinking. This perspective suggested that learning to think critically develops our ability to collect, interpret, evaluate, and choose information for the purposes of making knowledgeable choices. Brookfield (1987) has also offered a well-accepted definition of critical thinking. According to Brookfield, critical thinking is a process that includes creative thinking. He notes "workplaces in which innovation, creativity, and flexibility are evident are workplaces in which critical thinkers are prized" (p. 139). This can also be said of the classroom. If the classroom is a place which values creativity, diversity, and innovation, critical thinkers will be valued and will thrive in that type of atmosphere. Brookfield suggests that critical thinking enables us to both challenge assumptions, and imagine and explore alternatives. As noted earlier, the definition of critical thinking is a major topic in the literature, yet no agreement has been

made as to what critical thinking is. Since there is no consensus on a definition of this concept, it should be expected that there is no definite agreement on how to measure critical thinking.

Measuring Critical Thinking

"The lack of a universal operational definition for critical thinking has created considerable variability regarding the construct's measurement" (Worth, 2001, p. 10). Presently, standardized tools are used most frequently for assessing critical thinking; however, there are a growing number of researchers who are exploring the use of other forms of assessment, including portfolio and performance assessment (Spicer & Hanks, 1995). There are three major, standardized assessment tools being used in research today, the Watson-Glaser Critical Thinking Appraisal, the Cornell Critical Thinking Test, and the California Critical Thinking Skills Test.

The Watson-Glaser Critical Thinking Appraisal (Forms A & B), or W-GCTA, is an 80-item, multiple-choice test designed for grade nine through adult with five subtests: (1) Inference (discriminating among degrees of truth or falsity of inferences drawn from given data); (2) Recognition of Assumptions (recognizing unstated assumptions or presumptions in given statements or assertions; (3) Deduction (determining whether certain conclusions necessarily follow from information in given statements or premises); (4) Interpretations (weighing evidence and deciding if generalizations or conclusions based on the given data are warranted; and (5) Evaluation of Arguments (distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular question at issue). Watson and Glaser (1980) estimated internal consistency by

calculating split-half coefficients, which resulted in a range of 0.69 to 0.85. The W-GCTA also yielded a test/retest reliability of 0.73, and alternate-forms reliability of 0.75.

The Cornell Critical Thinking Test was first published in 1971, but the most recent version was introduced in 1985, and is based on Ennis' definition of critical thinking. There are two forms available, Level X intended for elementary and middle school students, and Level Z intended for advanced/gifted high school students and adults. Both versions consist of multiple-choice items, and employ a story format. The split-half reliability estimates range from 0.76 to 0.87 for Level X and from 0.55 to 0.76 for Level Z (Hughes, 1992). Hughes notes that lack of evidence of the test's construct validity is of particular concern. Nevertheless, this instrument is useful in the evaluation of teaching and/or curriculum development. It is not recommended for use in making important decisions that affect individuals.

The California Critical Thinking Skills Test was published in 1992, and contains 34 multiple-choice items. The test contains five sub-scores: (1) analysis, (2) evaluation, (3) inference, (4) deductive reasoning, and (5) inductive reasoning. According to McMorris (1995), the total-score internal consistency appears to be approximately .70. This instrument is gaining more appeal due to a somewhat supportive program of validation.

Out of the three major standardized instruments for measuring critical thinking, the W-GCTA is the most widely used instrument in research, mainly due to its reputation as the best developed instrument available in comparison to the other two instruments mentioned here (Spicer & Hanks, 1995). For these reasons, this instrument was chosen for this study.

In recent years, more support has been offered in the literature for assessing critical thinking through the use of performance assessments and portfolios (Brookfield, 1997; Spicer & Hank, 1995; Taylor, 2003). For example, Wiggins (1993) suggests that performance assessments allow learners to demonstrate what they can do in real situations, rather than articulate how a task or skill should be completed. The latter is usually shown through objective tests like those mentioned earlier. Brookfield notes "assessment of critical thinking should allow learners to document, demonstrate, and justify their own engagement in critical thinking" (p. 20). This is accomplished with much more success in performance assessments than with objective tests, because performance assessments require learners to engage in the critical thinking process with little direction in terms of options. The options in multiple choice tests can serve as a catalyst for critical thinking, but offer limited opportunity for learners to recognize and challenge their own assumptions, and develop and justify possible explanations and conclusions that go beyond the scope of the respective instrument. As Spicer and Hanks (1995) note "multiple measures of critical thinking should be used in assessment," especially since no one test covers all dimensions of critical thinking (p. 11). In this study, both a standardized test and performance assessments were used to assess participants' critical thinking skills. Although there is some agreement on what tools adequately measure critical thinking, there is less agreement on how to teach critical thinking.

Teaching Critical Thinking

Garrison (1991) suggested the most fundamental role of educators, particularly those of adults, is to encourage and develop critical thinking not only because critical thinking is a central component of education, but also because it is the one function that many learners find most difficult to perform themselves. Given this challenge, one would expect educators to conduct research regarding the effective ways of teaching critical thinking. However, few research studies in adult education have been done in this area. As Smith (1980) discovered, educators have proposed a number of interesting ideas for improving their students' critical reasoning, but they have reported little experimental research on the effectiveness of their instructional strategies. McMillan (1987) observed there is little evidence that critical thinking skills are shaped by specific instructional variables. Reboy (1989) indicated that the problem might be that many of the critical skills currently found in various taxonomies are not "teacher friendly" (p. 411). That is to say, they do not lend themselves easily to instructional design and measurement.

Before exploring the effectiveness of various instructional methods for improving critical thinking, two important questions should be examined. First, can critical thinking be taught, and if so, should critical thinking be taught directly or indirectly?

Can Critical Thinking Be Taught?

The claim that critical thinking skills can be taught is supported by a diverse body of evidence showing that "better critical thinking can be improved with appropriate instruction" (Halpern, 1993, p. 250). Chance (1986) reviewed several thinking programs and concluded that good thinking is a skill that can be taught, while Kurfiss (1988)

reported that critical thinking is a learnable skill. McPeck (1981) stated that to the extent critical thinking is a skill, it is teachable in much the same way other skills are teachable, namely through drills, exercises, or problem solving.

On the other hand, Dixson (1991) argued:

> *"teaching is usually accomplished through example and explanation. Although some explanation is possible, it is difficult to 'show' critical thinking. Since it is a cognitive, rather than a behavioral skill, we cannot directly observe the process. This makes it difficult to teach such a skill directly. It is far more likely that we can facilitate it." (p. 6)*

Dixson's view reflects one of the strongly held tenets of adult education, that educators should facilitate learning rather than impart knowledge (Brookfield, 1987; Knowles, 1980; Mezirow, 1981). Knowles notes that the most important distinction between facilitating and teaching is that the facilitator engages the learners as an equal partner in every step of the learning process. Because there is some agreement established in the literature that critical thinking skills can be enhanced through teaching and facilitation, it is important to consider whether critical thinking should be taught directly or indirectly.

Direct or Indirect Teaching of Critical Thinking

A frequent subject of interest in the literature is whether critical thinking should be taught directly or indirectly (Reboy, 1989). Browne, Haas, and Keeley (1978), de Bono (1983), and Statkiewietz and Allen (1983) found that direct training combined with practice and reinforcement is needed to facilitate the development of critical thinking. For

example, de Bono believed thinking skills can be taught directly, but in order for these skills to be successfully transferred, they must relate to circumstances individuals face in their personal or professional lives. de Bono stressed the element of practice to ensure students were comfortable with different strategies involved in critical thinking and problem solving.

Halpern (1993) claimed a broad-based, cross-disciplinary approach is most effective for critical thinking instruction. Further, Halpern contended that critical thinking skills do not necessarily develop as a by-product of discipline-specific work. The answer, according to Halpern, is specially designed courses that focus on generic thinking skills using varied examples because such courses provide the ideal combination of skills training and practice with transferring skills. Chance (1986) recommended integrating critical thinking instruction into subject matter courses.

Studies by Browne et al. (1978), Davidson and Dunham (1996), and Logan (1976) supported the view that direct teaching of critical thinking skills through courses designed specifically for that purpose improves students' critical thinking skills. On the other hand, a study by Ruminski and Hanks (1995) indicated that a large majority of journalism and mass communication faculty integrate instruction on how to think critically into subject matter within their communication courses. Courses designed specifically to teach critical thinking skills may be quite helpful in assisting learners in gaining these skills in that they offer the opportunity for students to practice using them. As Halpern (1998) suggests, practice is important to the development of these thinking skills. Nevertheless, the integration of this instruction into specific subject matter allows greater opportunity for transfer of learning and development due to greater opportunities

for practice in thinking through diverse situations and problems. Courses designed only to teach critical thinking offer merely a "laboratory approach" to teaching critical thinking, rather than a real-world approach (Ruminski & Hanks, 1995, p. 9). In this study, the thinking skills instruction was integrated into course curriculum in order to accomplish the goal of allowing practice of these newly developed skills in a wider array of situations, while enhancing the possibility of learning transfer.

Browne, Haas, et al. (1978) reported that after one academic quarter, college freshmen enrolled in a special course designed to teach critical thinking skills outperformed college seniors (control group) on a standardized post-test. Davidson and Dunham (1996) studied the impact of a critical thinking skills seminar on Japanese students enrolled in an English as a Second Language course. Students receiving the critical thinking skills training scored significantly higher on the standardized post-test.

Logan (1976) studied critical thinking skills as taught through a direct instruction approach in an experimental course for college freshman and sophomores. Results showed that students who took the experimental course were able to spot an average of 1.79 fallacies among a possible ten on a scale measuring inclination to think scientifically. When specifically told to think scientifically, they spotted 2.35 fallacies. Graduate teaching assistants in the same department who had not taken the experimental course scored 1.11 and 1.92 respectively. Although these studies show much promise, they lack any evidence of learning transfer to other situations. Halpern (1998) suggests critical thinking must be taught for transfer across domains. Halpern goes on to say:

> *"In critical-thinking instruction, the goal is to promote the learning of transcontexual thinking skills and the awareness of and ability to direct one's own*

thinking and learning. Although thinking always occurs within a domain of knowledge, the usual methods that are used in teaching content matter are not optimal for teaching the thinking skills that psychologists and other educators want students to use in multiple domains because instruction in most courses focuses on content knowledge (as might be expected) instead of the transferability of critical-thinking skills. For this reason, instruction in critical-thinking poses unique problems" (p. 451).

Instructional Methods for Teaching Critical Thinking Skills

McMillan (1987) pointed out that one of the primary means used to enhance critical thinking is classroom instruction. McMillan also notes that it is assumed that if teachers use appropriate instructional methods and curriculum materials, students will improve their critical thinking skills. Yet educators continue to struggle to uncover instructional strategies that have positive impact on students' critical thinking. As Gadzella and Masten (1998) suggest, past studies have not found overwhelming evidence that the one best way for teaching critical thinking has been discovered. Instead, these studies have only identified numerous approaches showing promise in better promoting critical thinking in classrooms.

McMillan (1987) reviewed 27 studies that investigated the effects of instructional methods, courses, programs, and general college experiences on changes in students' critical thinking. The various methods investigated included specific critical thinking-focused courses, traditional versus self-paced courses, and courses where different teaching and learning materials thought to enhance the opportunity for critical thinking

were implemented. Overall, the studies combined showed mixed results at best in regards to there effectiveness in enhancing critical thinking, thus McMillan concluded the results failed to support the use of any specific instructional method, course, or program to enhance critical thinking.

McKeachie, Pintrich, Lin, and Smith (1986) disagreed with McMillan's assessment. After completing an extensive review of literature, they attributed improvement in critical thinking to three instructional variables: (1) student discussion, (2) explicit emphasis on problem solving, and (3) explicit emphasis on methods to encourage development of metacognition, for example, the use of "thinking journals" to help learners focus on how they think. Whereas McMillan explored types of courses, programs, and teaching materials, McKeachie et al. explored specific variables of the teaching-learning experience.

A previous review of the literature by McKeachie (1970) cited seven studies to demonstrate that discussion classes are more effective than lecture classes in promoting retention and higher-level thinking. McKeachie's review of studies also indicated that other variables, such as programmed learning, independent study, and simulation, similar to the debate-style performance exercises suggested by Brookfield (1997), were found to be unrelated to critical thinking outcomes. Finally, McKeachie found student-centered classes rather than instructor-centered classes promoted higher-level cognitive outcomes. Howe and Warren (1989) described student-centered classrooms as ones, which involve students in paired problem-solving, cooperative learning settings, simulations, debates, and critical reporting sessions.

In the present study, both the modified CEA and Scaffolding approaches contained aspects of Howe and Warren's description of a student-centered classroom, especially the pairing of problem-solving with cooperative learning. However, in this study, the CEA approach focuses on metacognitive strategies through the Building Blocks and Tools, which Hanley (1995) and Halpern (1998) agree is key to assisting learners is understanding the individual differences in their personal thinking styles. Hanley suggests "teaching students a general model of how their minds work so that they could describe their own thinking skills and both students and instructors could refer to similar mental events through a common vocabulary" (p. 69). The notion of a common vocabulary is also important in the CEA approach, with the common vocabulary being the Building Blocks and Tools (Fisher, 2001). For Halpern, teacher/facilitators must encourage metacognitive monitoring, suggesting "When engaging in critical thinking, students need to monitor their thinking process, checking whether progress is being made toward an appropriate goal, ensuring accuracy, and making decisions about the use of time and mental effort" (p. 454). The Building Blocks and Tools in the CEA approach, such as Precisions and Accuracy, Self-Regulation, and Goal Orientation, support this metacognitive monitoring. Kurfiss (1988) agrees also, suggesting, "Metacognition may play an important role in developing objectivity, because it enables people to search out relevant knowledge and to reflect on their reasoning" (p. 45).

Baker and Anderson (1983) studied the effects of three inquiry methods, structured inquiry, focused inquiry, and open-ended inquiry, on students' skills in critical thinking about social problems. Structured inquiry involves providing clearly defined learning tasks that require analytical skills. Focused inquiry involves attention to a

specific problem, such as social problems, which was the content focus for the present study. Finally, open-ended inquiry "maximizes freedom" of learners to explore a problem(s) that grab their attention, and enhance their development of thinking skills through meaningful engagement. These methods, according to Kurfiss (1988), are useful in teaching causal relationships and correcting misconceptions. Instructors using the inquiry method deliberately ask questions, select examples, and use entrapment strategies to elicit misconceptions in students' thinking so they can be corrected. In the Baker and Anderson study, the structured inquiry method produced the highest percentage of gain, but the focused inquiry and open-ended inquiry also produced substantial percentage gains. These results support the finding of Kurfiss who examined numerous studies at the college level in which inquiry methods proved effective in improving critical thinking skills. Kurfiss defined inquiry methods as those methods teachers use to "encourage students to analyze a situation in search of causal factors" (p. 34).

Tien and Stacy (1996) examined three instructional environments in a university science course: (1) traditional, (2) guided inquiry, and (3) a course for non-science majors that emphasized critical reasoning. The traditional laboratory environment provided hands-on experiences in which the experiments were rote procedural exercises. Students were not required to engage in meaningful problem-solving activities or examine evidence critically. For the guided inquiry environment, the researchers based their instructional methods on a modeling, coaching, scaffolding, and fading paradigm. In the first phase, instructors modeled the process of thinking through and developing solutions to a given problem. After this, instructors coached students, providing encouragement to students, while also using scaffolding though question prompts. Finally, as students

gained confidence and success in thinking through given situations, assistance from the instructor was intermittently faded. During the guided inquiry process, students were asked to predict outcomes, observe data, and explain results. The third environment in the study was a critical reasoning course designed for non-science majors. Students were asked to apply chemistry to everyday problems and evaluate chemistry-related studies published in newspapers and magazines. The results of the Tien and Stacy study showed the critical reasoning environment was more successful in fostering inquiry skills than the other two environments. Critical reasoning students outperformed both guided inquiry and traditional students in regard to explaining scientific procedures and offering relevant improvements for fabricated studies.

The literature shows that a variety of approaches to improving critical thinking in the classroom have been explored, and some have shown positive outcomes. Nevertheless, McMillan (1987) cautions readers about placing too much trust in past studies exploring critical thinking. As McMillan shares:

> *"It should be pointed out, however, that like many educational programs for children of all ages, these studies are done in applied settings. This means, of course, that researchers must contend with nonrandom assignments, classes with different teachers, subject mortality in longitudinal studies, intrusion into normal academic programs, and other difficulties" (p. 15).*

The present study combats many of the problems mentioned by McMillan, including the use of only one instructor, random assignment of matched pairs, and non-intrusive implementation into a normal course situation. Also, most of the approaches explored in past studies, as Kurfiss (1988) suggests, are primarily teacher-focused approaches, where

instructors provided learners with some expert strategy, instead of student-focused approaches where students were encouraged to develop their own strategies for critical thinking, using the expert strategy merely as a springboard. These studies also lack a focus on metacognition, which is important to enhancing critical thinking skills, especially since individual differences in thinking styles are inevitable (Hanley, 1995; Halpern, 1998). For this study, a teacher-focused Scaffolding approach was compared to a modified version of the Cognitive Enrichment Advantage approach, a student-focused approach that focuses on metacognitive strategies and learning transfer, to explore their utility in facilitating improvement in critical thinking skills.

Scaffolding and Cognitive Enrichment Advantage Approaches

Scaffolding is a concept that has evolved from researchers' interpretation of Vygotsky's theories, and is based on the idea of providing assistance to a learner within the learner's zone of proximal development (Dabbagh, 2003). Vygotsky (1978) defines the zone of proximal development as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). Scaffolding involves supporting novice learners by limiting the complexities of the learning context and gradually removing those limits as learners gain the knowledge, skills, and confidence to cope with the full complexity of the context. According to Ashman and Conway (1997), "there are two notions inherent in scaffolding: first, there is a reciprocal relationship between the instructor and the learner – the former provides the content and focus on appropriate processes, and the latter is actively

involved in gaining both knowledge and skills; and second, there is a progressive transfer of responsibility for initiating learning from the teacher to the learner" (p. 98). In order to show clear differences between the two approaches, the development of reciprocal relationships between the instructor/facilitator was encouraged. Also due to the short intervention period, the support was not faded. Most often, as was the case in this study, the support in a scaffolding approach is provided by way of question prompts (Ge & Land, 2003; Saye & Brush, 2002). Although there is little agreement in the literature about what approach is best for teaching critical thinking, there is agreement that a successful approach breaks down the thinking process (Hanley, 1995). This makes the Scaffolding approach an ideal approach to explore due to the use of question prompts and cues to provide support throughout the critical thinking process.

The Cognitive Enrichment Advantage approach, or CEA, draws on the work of Reuven Feuerstein, Lev Vystosky, Jean Piaget, and others (Greenberg, 2000b). As Greenberg explains, "CEA helps students develop personal learning strategies based on explicit knowledge of twelve cognitive processes that help them think effectively and eight affective-motivational approaches to learning that help them become more independent and interdependent learners" (p. 2). Another important feature of the CEA approach is its view of the classroom. In CEA, the classroom is viewed as a "laboratory for learning" (p. 41). In a CEA classroom, the process of thinking is seen as important as the content objectives within a curriculum (Ashman & Conway, 1997; Greenberg, 2000b). This is a clear difference from a traditional, direct instruction approach where, in most cases, content is of central importance.

As an approach to teaching and learning, CEA is greatly influenced by Feuerstein's theory of mediated learning experience. Mediated learning experience is "the application of adult-child interactions to assist cognitive development in a teaching environment" (Ashman & Conway, p. 138). They go on to note "mediation ensures that students acquire relevant cognitive skills when they may have been unable to gain those skills through previous learning experiences" (Ashman & Conway, p. 138). In mediated learning, there are four essential qualities: (1) reciprocity; (2) intent; (3) meaning; and (4) transcendence. The goal of reciprocity is establishing a positive relationship, which embraces trust, acceptance, and understanding between a learner and an instructor (mediator). Reciprocity is key in establishing an honest, student-focused classroom where meeting the needs of learners can be the primary focus, and is the first step in successfully implementing the other three qualities of mediated learning. Intent is established through the instructor/mediator's preparation. The instructor/mediator should be prepared in a way where establishing students' focus on the intended goals and objectives is somewhat easily accomplished. However, there should be a level of freedom for changes in intent based on the needs of the students. As Greenberg (2000b) notes "intent must be in sync with reciprocity" (p. 37). The focus on meaning is important in creating a learning experience that is personally meaningful to the learners. It is the responsibility of the instructor/mediator to find what is important for the learners, and use it to stimulate the interaction. The final essential quality of mediated learning experience is transcendence. Feuerstein and Feuerstein (1990) define transcendence as "the orientation of the mediator to widen the interaction beyond the immediate primary and elementary goal" (p. 21). "Transcendence is expanding understanding beyond the current

learning context" (Greenberg, 2000b, p. 39). Although related to the concept of transfer of learning, which is explained later in this chapter, transcendence goes far beyond transfer. Transcendence involves going beyond the learning experience in a manner that helps transform individuals into more effective learners. It involves exploring the learning experience in a "big picture" context. As Feuerstein and Feuerstein illustrates:

> *"making an individual acquire a skill or rendering him competent in an area of knowledge is the goal of the interaction between parent and child, teacher and student. The intention to make him feel competent, however, clearly transcends the immediate goal of skill or competence acquisition...[Transcendence] creates in the mediatee a propensity to enlarge his cognitive and affective repertoire of functioning constantly" (p. 20-22).*

The primary goal of both of these approaches is to assist learners in finding success in the learning process; however, there are differences between the two approaches.

As mentioned earlier, the CEA approach encourages students to develop their own personal learning strategies. Unlike CEA, the Scaffolding approach does not focus on encouraging students to develop personal learning strategies. Instead, learners are taught expert strategies to use in learning situations. The second major difference between CEA and Scaffolding is the CEA focus on learning transfer, which is related to the essential quality of mediated learning, transcendence, mentioned earlier. Haskell (2000) defines transfer of learning as "our use of past learning when learning something new and the application of that learning to both similar and new situations" (p. xiii). As McKeough, Lupart, and Marini (1995) explain:

"Transfer of learning is universally accepted as the ultimate aim of teaching. However, achieving this goal is one of teaching's most formidable problems. Researchers have been more successful in showing how people fail to transfer learning than they have been in producing it, and teachers and employers alike bemoan students' inability to use what they have learned" (p. vii).

For CEA, transfer is furthered through bridging. Bridging is a technique for "connecting the use of a Building Block or Tool in one setting to its use in other settings by means of development of a general rule that applies in all settings" (Greenberg, 2000b, p. 127). This general (decontextualized) rule is called a bridging principle, and is usually developed collaboratively by the course facilitator and students. From there, students are encouraged, with assistance from the instructor as needed, to develop examples using the bridging principles for home, school, social, and work situations. In the Scaffolding approach, there is no explicit focus on transfer.

Another major difference between Scaffolding and CEA is the latter's focus on both the cognitive and affective aspects of learning through what Greenberg (2000b) calls the "Building Blocks of Thinking" and "Tools of Learning." As Schunk and Zimmerman (1994) suggested, as cited by Greenberg, "research has shown a close relationship between affect and motivation with learning and academic performance" (p. 57). Often times, students have more success in one content area than they do in others. This sometimes brings about a low level of self-efficacy related to content in which the student has experienced less success. This often influences learners' level of commitment to the learning process. The balance of the Building Block and Tools assists learners in improving both their cognitive skills and their ability to understand certain feelings and

emotional responses in order to use these feelings for self-motivation and to energize the learning experience, thus changing self-efficacy. According to Thayer-Bacon (2000), most existing perspectives on critical thinking neglect the affective portion of the thinking and decision-making process. Learners are encouraged to use these Building Blocks and Tools as stepping-stones to developing their own personal critical thinking strategies.

The role of the teacher is another major difference between these two approaches. For scaffolding, the teacher is responsible for imparting knowledge to the pupil. As Vygotsky (1978) suggests, learners should be guided by a "more capable peer" to solve problems and carry out tasks that are beyond their independent abilities. In CEA, the teacher's role is that of facilitating learning as a mediator of learning experiences, according to Feurerstein's theory (Feuerstein & Feuerstein, 1990). The facilitator is responsible for assisting learners in creating their own knowledge and strategies. This approach appears to allow the opportunity for learners to become more personally connected to the learning experience, while hopefully helping learners find personal meaning within the learning experience, another difference in focus between these two approaches.

As Feuerstein and Feuerstein (1990) note, the mediation of personal meaning "answers the question of why and what for" in any learning experience, opening the door for learners to find personal relevance in the experience (p. 24). In other words, the focus on personal meaning energizes the learning experience by assisting learners in finding personal relevance. It is reasonable to assume that when one is engaged and finds relevance in any experience, he/she tends to gain more from that experience. In order to

assist learners on this journey to personal meaning, it is important that teachers share their own personal interest and affective connection to each learning experience.

Finally, another major difference between these approaches is the evaluation process of the learning experience. In CEA, each member of the learning community has a responsibility in the assessment and evaluation of learning. Each learner has both the opportunity for self-evaluation and the opportunity to critique and assess the contributions of colleagues. By focusing on a more collaborative approach to evaluation of the learning experience, new perspectives are created that enhance the learning of both the facilitator and the learners. In the scaffolding approach, the teacher has sole responsibility for deciding the success or failure of a learning experience.

Although the two approaches explored in this study are different, each has its strengths. In the Scaffolding approach, the use of question prompts and cues allow structure and support in the critical thinking process, which is a major strength for this approach. The learner-focused atmosphere in a CEA classroom empowers the learner through the meaningful, reciprocal relationship between the teacher and pupil, which is important for any evocative learning experience and is a major strength for this approach. As Wade (1995) concludes:

> *"The teacher's role seems critical in fostering student empowerment. In this setting, the teacher's heightened awareness of personal, school, and community values, coupled with specific strategies for providing opportunities for student empowerment, was a necessary part of this process. At the heart of the empowering experience lies student ownership. To the extent that opportunities for meaningful connections between students' values and interests and their*

school activities were provided, the students' empowerment was enhanced" (p. 353).

Cognitive Education Approaches and Critical Thinking

Although earlier in this chapter several studies were presented that explored various teaching approaches for enhancing critical thinking skills, this section will present studies that have explored the use of cognitive education approaches to enhance cognitive abilities in students. Cognitive education refers to the application of cognitive theory in education. Ashman and Conway (1997) believe cognitive education involves improving the critical thinking and problem solving abilities of learners. They note, students are "rarely provided with instruction or experiences that allow them to learn about learning, and learn about problem-solving" (p. 78). Cognitive education approaches focus attention on "how to derive maximum information from the learning or problem-solving situation, how to formulate a suitable strategy for dealing with the task at hand, how to enact the strategy, and monitor performance until the goal is achieved" (p. 78).

Notari, Cole, and Mills (1992) examined the effects of participation in the Mediated Learning Program (MLP) on the cognitive and language skills of special needs children. The MLP was "a comprehensive preschool curriculum designed to facilitate the development of social and cognitive problem-solving skills in normally developing children and children with disabilities in an integrated setting" (p. 171). Notari et al. found that the program was effective in enhancing cognitive and language skills in special needs preschoolers.

Hay (2000) evaluated the effectiveness of the Process-Based Instruction (PBI) procedure. PBI was described by Ashman and Conway as a teaching strategy in which students are encouraged to develop plans and to revise those plans as their learning needs change. As Hay noted, our findings demonstrate that "students involved in PBI were able to maintain their level of proficiency with a task, while students without PBI reduced their proficiency over time" (p. 170).

Ge and Land (2003) examined the effects of question prompts in scaffolding undergraduate students' problem-solving processes in an ill-structured task in problem representation, developing solutions, making justifications, and monitoring and evaluating. Ge and Land found that question prompts had significantly positive effects on student problem-solving performance. In the present study, students in the Scaffolding group were not provided with a list of question prompts. Instead, the instructor provided verbal question prompts during group discussions around the problem-solving scenarios.

Henningsen and Stein (1997) explored how classroom-based factors can shape students' engagement with mathematical tasks that are set up to encourage high-level mathematical thinking and reasoning. Based on observation notes taken by observers, five factors appeared to be prime influences associated with maintaining student engagement and encouraging higher levels of thinking and reasoning: (1) use of tasks that build on students' prior knowledge, (2) scaffolding from teachers and/or peers, (3) appropriate amount of time to complete tasks, (4) modeling of high-level performance, and finally, (5) continual press for explanation and meaning from students. Again, this study suggests that scaffolding is only part of a total teaching package. One of the five factors presented by Henningsen and Stein is essential to the CEA approach, maintaining

a sustained press for explanations from students and personal meaning. In the CEA approach, students are constantly challenged to provide justification for the responses they provide and the strategies they use to develop their responses. They are also constantly encouraged to seek personal meaning in all learning experiences.

Rojas-Drummond, Mercer, and Dabrowski (2001) compared teachers using a "conventional, formal, directive approach," which they called the "official" method to teachers who use "a more interactive, collaborative, supportive, scaffolded" approach, which was part of the "High Scope" method when teaching 5-year-old Mexican children mathematical problem solving skills (p. 179). These methods were explored to identify specific characteristics of the classroom that facilitate improvement in learners' problem-solving abilities. The key characteristics identified were: (1) student collaboration, (2) use of question prompts (scaffolding), and (3) expressive feedback provided to students from teachers. Based on these findings, Rojas-Drummond et al. concluded that scaffolding alone was not helpful in facilitating improvement in the students' problem-solving skills. Its combination with offering both the opportunities for student collaboration and the presence of ample, descriptive feedback from the instructor made the "High Scope" approach more successful. In the present study, the Scaffolding intervention included the opportunities for student collaboration through working on practice worksheets with partners; however, the instructor's feedback was confined to the pre-established question prompts and cues. Also, a similar method for discourse (content) analysis was used in the present study in order to identify key characteristics among journal entries completed by students in the CEA group where students were asked to reflect on their use of the Building Blocks and Tools in their other classes.

The conclusions made by Rojas-Drummond et al. are supported by the position of Pressley, Hogan, Wharton-McDonald, and Mistretta (1996), who suggest that scaffolding is only part of an effective instruction, "but that instruction fully supporting the development of student thinking includes much more" (p. 138). Other important elements of instruction fully-supporting the development of learners' thinking include: (1) explicitly explaining and modeling skills students need to learn, (2) believing that learners who are varied in preparation levels and academic abilities require diverse approaches to education, (3) asking questions not simply to evaluate learners but rather to diagnose their misunderstandings, (4) caring about learners and the willingness to expend the substantial personal efforts required for students to learn, and (5) creating a positive, well-managed classroom.

Although many past studies have shown promise in enhancing learners' critical thinking, this study seeks to explore approaches that focus on various characteristics that have been identified as important, yet not present in past studies. The Scaffolding approach in this study is a more rigid, teacher-guided method than previously explored in other studies. The modified CEA approach explored in this study includes focus on learning transfer, as well as a focus on metacognitive strategies, which are all characteristics cited in the literature as important in teaching critical thinking (Hanley, 1995; Halpern, 1998).

CHAPTER THREE:

METHODOLOGY

Research Design

A modified pre-test/post-test comparison group design was employed in this study. Figure 3.1 provides a visual representation of the study's design. This study included three phases: (1) Pre-Intervention Phase, (2) Intervention Phase, and (3) Post-Intervention Phase. The Pre-Intervention Phase included the first of three critical thinking assessment administration sessions to obtain baseline data of all participants' critical thinking ability, and a two-week direct instruction period in order to provide basic critical thinking knowledge for all participants. After the pre-intervention phase, matched pairs were randomly assigned to the CEA group and the Scaffolding group, based on scores

Modified Pre-Post Design					
Group A (CEA Group):	**O**	**X_P**	**O**	**X_A**	**O**
Group B (Scaffolding Group):	**O**	**X_P**	**O**	**X_B**	**O**

O = Assessment Session; X_P = Pre-Intervention Phase; X_A and X_B = Intervention Phase

Figure 3.1: Study Design Map

obtained during the second assessment administration session. The Intervention Phase included five weekly 40-minute teaching sessions for both groups. The Post-Intervention Phase included the final assessment administration session.

Description of Participants

The sample consisted of thirty-six African American students enrolled in one of three freshman seminar courses designed for first-year freshman merit scholarship recipients. All of the participants were "traditional" age students. They all held a minimum grade point average of 3.4 in their core high school courses, which included four units of English, two units of Algebra, one unit of either Geometry, Trigonometry, Advanced Mathematics or Calculus, two units of a natural science (including at least one unit of Biology, Chemistry, or Physics), one unit of American History, one unit of either European History, World History, or World Geography, two units of a single foreign language, and one unit of a visual or performing art. Recipients were also required to have a minimum score of 23 on the ACT or 1060 on the SAT.

The study sample consisted of 7 males (19.4%) and 29 females (80.6%). This male-female ratio was comparable to that of the other two sections of the freshman seminar course. Overall, the number of female recipients is significantly higher than male recipients for this scholarship.

Performance Measures

Watson-Glaser Critical Thinking Appraisal

The Watson-Glaser Critical Thinking Appraisal (Forms A & B), or W-GCTA, was administered to the participants in this study. As noted earlier, Watson and Glaser (1980) estimate internal consistency by calculating split-half coefficients, which resulted in a range of .69 to .85. The W-GCTA was administered prior to and after the Intervention Phase.

Critical Thinking Performance Assessment

Critical thinking performance assessments tasks developed by the Comprehensive Adult Student Assessment System (CASAS) were also administered in this study. Matched exercises were administered before and after the Pre-Intervention Phase, and again after the Intervention Phase. In order to screen for matched exercises for each of three administration sessions, two independent reviewers from two Mid-Atlantic universities were asked to review 30 exercises. Scenarios from two CASAS categories were included: (1) historical situations and (2) employment-related situations. The reviewers were first asked to independently place the items in three groups: (1) Narrative items; (2) Figural/Pictorial Items; and (3) Other. After this, the reviewers were asked to independently evaluate each item in the respective categories, and rank the items based on what items, in their opinion, offered the best opportunity for critical thinking. The first seven exercises to be selected for administration were those where there was 100% agreement between reviewers in both group placement and ranking. The remaining five

exercises were selected based on 100% agreement between reviewers in both group placement and top-five rankings. Each of the three administration sets included four exercises, including two figural/pictorial exercises (one each from both the Social Studies and Employability sets), one narrative exercise (Social Studies), and one "Other" exercise (Employability). Sample exercises can be found in the appendix (Appendix A).

Course Description

The freshman seminar course was presented in weekly 80-minute sessions during the students' first semester on campus. It was designed to provide first-year freshman students in this scholarship program important academic and social survival skills thought necessary for success in a university setting. Some topics covered in this course included study habits and the importance of maintaining a high grade point average, developing positive relationships with roommates and professors, and effective money management. Table 3.1 shows the course topic areas for each of the seven intervention weeks of the study period. Reading assignments related to each week's topic area for all of the course's sections came from Stephen Covey's *Seven Habits of Highly Effective Teens*. Although the topic areas to be covered in the course were determined by the scholarship program's director, each instructor was provided freedom in regards to course assignments, placement of the topics for discussion, and the approach to exploring these topic areas.

Table 3.1: Course Topics by Session

Direct Instruction Session 1	Study Skills and the Importance of Maintaining a High GPA
Direct Instruction Session 2	Money Management for College Students
CEA and Scaffolding Session 1	Healthy Living
CEA and Scaffolding Session 2	Positive Roommate Relationships
CEA and Scaffolding Session 3	Issues of Campus Diversity
CEA and Scaffolding Session 4	Final Exam Preparation
CEA and Scaffolding Session 5	Becoming a Mover and Shaker

Procedures

Pre-Intervention Phase

In week one of the study period, an introduction to both the course and the study was provided for all students in the freshman seminar. During this week, students were provided with an informed consent form (Appendix B), and asked to read the form and return the forms the following week. After all consent forms were returned to the principal researcher in week two, each student was given a pre-coded card with a random participant number to be used throughout the study period. Each of the thirty-seven students in the class returned a signed informed consent form to participate in the study; however, one participant withdrew from the study during the Intervention Phase due to withdrawal from the University. Also during week two, each participant completed the first set of critical thinking performance assessments to obtain a baseline measure of critical thinking ability.

Weeks three and four consisted of the Pre-Intervention Phase of this study. Each class session in this first phase lasted 80 minutes. In this phase, a direct instruction approach was used to normalize the group. In other words, participants were provided with a common critical thinking knowledge base. At the beginning of each session in the Pre-Intervention Phase, the instructor lectured on the content areas for that session, using slides and/or transparencies. After the content information was presented, the five components of critical thinking from the operational definition used in this study were presented to the class. Those components were: (1) identify problems, (2) analyze problems, (3) determine possible explanations, (4) assess one or more explanations; and

(5) state conclusions. Due to technical problems with equipment in week four, these five components could only be shared orally with the participants. After these components were presented in both Pre-Intervention sessions, students were given the opportunity to ask questions about the components presented. When questions were asked, the instructor responded to the question by re-stating the material using different words, and/or pointing out the previously presented information on the slide or transparency. After responses were given to all questions, students were presented with a worksheet (Appendix C) containing a scenario related to the topic for that session, and given fifteen minutes to work with a partner to respond to the two questions provided on the worksheet. The first question asked for partners to share what they believed the main character of the scenario should do in the given situation, while the second question asked the partners to explain why the character should handle the situation in that manner. The instructor then asked each pair to share their responses to the questions with the entire class. In the direct instruction sessions, only right/wrong feedback was offered to each pair. For correct answers, the facilitator responded by saying "definitely on point" or "good answer." For incorrect answers, the facilitator responded by saying "not quite" or "I think you should think about that some more."

Pre-Test Assessment

To obtain a pre-intervention measure of critical thinking, students were administered the W-GCTA and set two of the critical thinking performance assessment exercises during the fifth week. In order to control for possible differences in forms, equal numbers of both Form A and Form B were randomly selected and administered to

the participants. For the post-intervention administration, participants were administered alternate forms. Based on the total raw scores from the W-GCTA, matched pairs were randomly assigned to two groups, the CEA group and the Scaffolding group. During week six, students completed their midterm project, which was a fact-finding assignment where they were asked to identify and visit various offices and other key resources on campus. They were given the entire week to complete the project, and submit it during session seven.

Intervention Phase

Sessions seven through eleven were the Intervention Phase of the study. During this phase, each group met for 40 minutes each week for five weeks. For both groups, the first session of this phase (session seven) differed in certain ways from the other four sessions.

Scaffolding Group Intervention

In the Scaffolding group, the first session of the Intervention Phase began with a brief discussion of the topic area for that week. After the discussion, the instructor completed a sample worksheet (Appendix D) for the class, modeling the six-step expert strategy for critical thinking presented on the worksheets. Table 3.2 shows the six steps of the expert strategy. In addition hints that were included along with each of the six steps for critical thinking on the worksheet. After the instructor completed a sample worksheet, partners were asked to complete a similar practice worksheet with a different scenario. The class was given 10 minutes to complete the worksheet with a partner. Partners were

Table 3.2: Six Steps and Worksheet Hints for Critical Thinking

STEP ONE
Write 2 Tentative Solutions to the First Question *(Hint: Think about the facts and what you can assume)*
STEP TWO
List 1 to 3 problems related to one or both of your solutions above *(Hint: Think about some doubts you discovered with your solutions)*
STEP THREE
Record some details about each problem listed above *(Hint: Think about what you may be taking for granted in your solution or in your problem)*
STEP FOUR
Write a draft explanation for each tentative solution *(Hint: Use the problems you identified about some statements that lead to your conclusion)*
STEP FIVE
Place a "star" beside the explanation above that you think is the best *(Hint: Think about whether your explanation is important and whether it is really related to the conclusion)*
STEP SIX
Write your final conclusion below *(No Hint)*

then asked to share their final conclusions from the worksheet. For both groups, partners were paired during session seven based on their proximity in classroom seating, and each set of partners remained the same for the remainder of the Intervention Phase. If the instructor deemed the responses unsatisfactory, students were asked to revise their answers and were provided with prompts and cues from a pre-developed list (Appendix E), based on the deficiencies found in the answer. For example, if the instructor found the final conclusion to be deficient, he would ask the respective partners' to provide their response to another question on the worksheet based on what in the final answer seemed to be the root of the answer's deficiency. If problems were found with this second response, the appropriate prompt or cue from the pre-planned list was then offered to the partners to assist them in revising their answers. If the partners offered a satisfactory response, the instructor provided positive feedback, by saying, "I see you're using the expert strategy."

One important note about the Scaffolding approach is that the instructor always provided information about the critical thinking process before asking students questions. In the Scaffolding approach, the instructor was seen as the more knowledgeable member of the learning community, and thus, has the responsibility of providing the information rather than assisting students in developing and justifying their own answers. Finally, at the end of the initial session for the Intervention Phase, partners were given worksheets to complete for homework, which were the focus for the following week's discussion.

For sessions eight through eleven, a brief discussion of the topic area of the week began the session. After the discussion, partners were asked to share their final conclusions from the worksheet completed for homework. As was done in the initial

week of the Scaffolding intervention, partners were provided with a prompt/cue to assist them in revising their answers. If the partners offered an appropriate response, the instructor provided positive feedback, by saying, "I see you're using the expert strategy."

Modified CEA Group Intervention

In the CEA group's first intervention session, the instructor began by sharing his meaning for critical thinking through a personal experience related to the topic for that week, where he had to use critical thinking to make a decision about the problem or situation he was experiencing. Students were then asked to share any personal examples they had in which they used critical thinking to assist them in solving a problem or making a decision about a particular situation. This brief sharing was followed by a short discussion of the topic for that session. After the discussion, the instructor facilitated the development of what are called *mindmaps,* one for a specific cognitive process concept (called "Building Block of Thinking" in CEA) and another for a specific affective/motivational concept called "Tools of Learning" in CEA) (Appendix F). The instructor asked students to share "critical ingredients" of the concepts being mindmapped. Each idea shared by the students was placed in circles around the concept label in relation to ideas shared by others. Table 3.3 shows the Building Blocks of Thinking and Tools of Learning that were introduced to the CEA Group each session during the Intervention Phase. A list of definitions for these Building Blocks and Tools is available in the appendix (Appendix G).

After the class mindmap was created, a pre-developed mindmap was shown on a transparency. The purpose of this mindmap was to highlight the critical attributes of the

Table 3.3: Building Blocks of Thinking and Tools for Learning Introduced by Week

WEEK	BUILDING BLOCK OF THINKING	TOOL FOR LEARNING
CEA Session 1	Planning	Goal Orientation
CEA Session 2	Expression	Self-Regulation
CEA Session 3	Making Comparisons	Self-Development
CEA Session 4	Precision & Accuracy	Feeling of Challenge
CEA Session 5	Exploration	Sharing Behavior

various Building Blocks for Thinking and Tools of Learning, as contained in the CEA approach. While highlighting these critical attributes, the instructor linked the mindmap on the transparency with that which was developed by the group, pointing out similarities and differences. After the mindmaps were completed and discussed, the instructor presented the six-step expert strategy for critical thinking as used with the Scaffolding group. While presenting these steps, the instructor related them to the Building Block and Tool presented through the mindmaps. Within this discussion, students were asked to share examples of personal strategies, based on a Building Block and Tool, which would help them be successful using the six-step expert strategy. After discussing personal strategies, the instructor facilitated the completion by partners of a practice worksheet (Appendix H).

The worksheets completed in the CEA group were the same as the worksheets completed in the Scaffolding group. Both worksheets included identical scenarios. They also both included the six steps for critical thinking, along with the hints. However, two extra questions were added to the CEA worksheet. Before completing the first of the six steps, the worksheet asked students to use the Building Block or Tool for that lesson to describe a personal strategy they would use to think critically about the scenario and to complete each item on the worksheet. After completing this question on the worksheet, the students then responded to the six steps for critical thinking found on the worksheet. The final question on the worksheet asked students whether they refined their answers to any of the questions as they completed the worksheet, and if so, how they went about refining those answers.

After each pair of students completed the practice worksheet, the instructor asked students questions about each item on the worksheet and the hints related to those items. Unlike the feedback limited to pre-panned prompts and cues for the Scaffolding group, the instructor provided feedback in a variety of ways to CEA students. All students were encouraged to provide their colleagues with feedback as they discussed the responses to the worksheet. Also, the instructor provided descriptive feedback to the students, pointing out how they did or did not use the expert strategy, and also how a personal Building Block or Tool strategy either assisted them or could have assisted them in the completion of the worksheet. Finally, students provided themselves feedback through self-evaluation. Students were asked to explain how successful they felt they were in using the six steps for critical thinking, the hints, and also any personal strategies they developed using the Building Blocks and/or Tools.

One additional step in the CEA approach, based on principles derived from research, was used to facilitate transfer of student development and use of learning strategies. Each class ended with the generation of a bridging principle and examples. For example, at the conclusion of a session in which the Building Block, Precision and Accuracy, was mediated, students were presented with a transparency with the following statement: *If I use Precision and Accuracy by* _____, *then I will be a better critical thinker*. Students then completed the statement with a critical attribute that was discussed during the mindmap phase of the class session, such as: *If I use Precision and Accuracy by gaining a precise understanding of the specific situation, then I will be a better critical thinker*. After the bridging principle was completed, students were encouraged to share examples of how this principle could be used in situations in home, school, work, and/or social settings.

Unlike the Scaffolding approach where the instructor provided information before asking questions regarding the process of critical thinking, students in the CEA group were asked questions before information was provided about critical thinking or the Building Blocks and Tools in order to facilitate student development of their own personal strategies for solving problems and making decisions, and to help them integrate prior knowledge and understanding with new concepts presented during the session. At the end of each session of the Intervention Phase, students were given a worksheet to complete for homework with their partners. Like with the Scaffolding group, homework worksheets were the focus for the following week's discussion. Sessions eight through eleven in the CEA group were the same as the first intervention session with one exception. Rather than the instructor leading participants' completion of a worksheet

during the session, the instructor facilitated a discussion with participants regarding worksheets completed by partners for homework. In order to explore the CEA group participants' extent of learning transfer, each participant was asked to type a one-page journal entry after session ten, reflecting on their use of the Building Blocks of Thinking and Tools for Learning in their other university courses and activities.

Post-Intervention Phase

In week twelve, the W-GCTA was re-administered to all participants, using the alternate form of that which was administered at pre-intervention as noted earlier, for the post-intervention administration. In addition, the final set of critical thinking performance assessment exercises was administered to all participants.

Observer Training and Assessment Scoring Procedures

It is important to note that the principal investigator served as instructor in each phase of this study. In an effort to ensure treatment integrity, checklists (Appendix I) were developed by the research supervisor and the principal researcher, with assistance from a committee of other doctoral students in educational psychology. This process for documenting treatment integrity was adapted from that used by Popkin and Skinner (2003). Prior to the intervention period, two independent observers were trained to use the treatment integrity checklist through several observations of sample direct instruction, CEA, and Scaffolding practice lessons. Observers were also provided with videotapes of sample lessons for the purpose of practicing use of the treatment integrity checklist. The training period continued until 100% agreement between observers was obtained for each

of the three types of intervention lessons. One observer attended each of the seven teaching sessions of the study, with a second observer attending three of the teaching sessions rating the intervention facilitator separately from the other observer. Percent of agreement was computed by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The total percent of agreement was 99%.

Two social work doctoral students served as the scorers for all of the W-GCTA answer sheets. Both of these students had prior experience scoring this instrument. Nonetheless, the principal investigator held one training meeting with both scorers to serve as a refresher course on using the standardized scoring grid developed by the instrument's publisher. Finally, two other educational psychology doctoral students served as scorers for the critical thinking performance assessment exercises. The research supervisor and the principal investigator developed a scoring rubric (Appendix J). In order to ensure that there was agreement between what was being measured by the W-GCTA and the critical thinking performance assessments, the sub-tests of the W-GCTA were used as the basis for the rubric development. In addition to the W-GCTA sub-tests, the *Holistic Critical Thinking Scoring Rubric* developed by Drs. Peter and Noreen Facione was used as a style example during the development phase of the scoring rubric used in this study. The scoring rubric consisted of four sub-scale: (1) Conclusions/Explanations, (2) Assumptions, (3) Alternate Conclusions, and (4) Alternate Explanations. For each sub-scale, scores could range from 4 to 12, making range of total possible scores from 16 to 48. As was the case with the W-GCTA, total scores were used for analysis. Once the principal investigator and research supervisor had scored sample

exercises to assess reliability, two training sessions were held with the scorers to continue the reliability assessment process, as well providing an opportunity to obtain feedback from the scorers on the user-friendliness of the instrument. Based on recommendations from the scorers, changes were made to the instrument. A third training meeting was held to allow scorers an opportunity to practice using the final revised scoring rubric, while continuing the reliability assessment process. After the last training meeting, scorers met daily, and scored independently, for one week to complete scoring of all critical thinking performance assessment exercises. The scorers were blind to whether exercise sets were baseline, pre-intervention, and post-intervention measures.

Statistical Analysis Procedures

With assistance from the university's statistical consulting center, several statistical analysis procedures were performed on the data. Paired-sample *t*-tests were performed on the pre- and post-test scores from both the W-GCTA and the critical thinking performance assessment (CTPA) to measure changes of each individual group. A paired-sample *t*-test was also performed on the baseline and pre-test CTPA scores to measure any changes among all participants from the direct instruction of information related to critical thinking during the Pre-Intervention Phase of the study. Analyses of covariance (ANCOVA) were performed using the pre- and post-test data from the CTPA and W-GCTA in order to explore whether there was a significant difference between the performance of the CEA and Scaffolding groups. In addition, critical thinking performance assessment total scores were also analyzed for inter-scorer reliability using the Pearson's r correlation model, yielding a correlation coefficient of 0.84. Finally,

discourse (content) analysis was performed on the journal entries completed by participants in the CEA group to identify and record frequencies of key characteristics related to participants' transfer of what was learned during the CEA intervention to their other university activities. A team comprising of the researcher, one graduate student, and an expert in content analysis analyzed these journal entries.

CHAPTER FOUR:

RESULTS

As noted in the previous chapter, a standardized instrument (W-GCTA) and performance assessment exercises (CTPA) were administered at certain times during the study to measure changes in participants' critical thinking skills. Assessments were administered to obtain baseline, pre-intervention, and post-intervention measures for both the CEA group and the Scaffolding group. In addition, participants in the CEA group completed one journal entry, reflecting on their use of the Building Blocks and Tools outside of the Counselor Education 205 course.

Results of Measures to Determine Effect of Direct Instruction

The first research question in this study sought to explore significant differences in critical thinking performance after all participants received direct instruction concerning components of critical thinking during the study's Pre-Intervention Phase. To measure these changes, a paired-sample *t*-test was performed on the baseline and pre-test CTPA scores. The results of a two-tailed paired sample *t*-test showed no significant change in critical thinking performance between baseline and pre-test measures, $t(35) = 1.028$, $p > 0.05$). The mean (with standard deviations in parentheses) CTPA baseline score was 29.17 (5.72), while the mean CPTA pre-test score was 28.53 (5.78). This represents a mean score decrease of 0.64 for participants in both groups.

Results of Measures to Determine Differences Between the CEA Group and Scaffolding Group Performances

The second research question sought to explore whether there were significant differences between the performance of the CEA and Scaffolding groups based on the pre- and post-test scores from the CTPA and the W-GCTA. Two one-way analyses of Covariance (ANCOVA) were performed to explore these differences. For both the W-GCTA and CTPA analyses, the pre-test scores served as the covariate. A test of homogeneity of regression was performed within each ANCOVA as a means of testing the equal slope assumption. Results of both analyses suggested that this assumption was tenable. Results indicated no significant difference in critical thinking performance between the two groups, $F[1, 33] = 0.88, p > 0.05$). However, ANCOVA results, based on the W-GCTA pre-and post-test scores, showed a significant difference in critical thinking performance, $F[1, 33] = 6.52, p < 0.05$). Since a significant difference was found between the critical thinking performances of the two groups, based on the W-GCTA, paired-sample *t*-tests were performed to explore each group's performance pre- to post-test.

Results of Measures to Determine Effects of the CEA and Scaffolding Interventions

The third and fourth research questions sought to explore significant differences in critical thinking performance within CEA and Scaffolding groups, respectively, based on the pre- and post-test scores from the CTPA and the W-GCTA. Paired-sample *t*-tests were performed on these scores for each group to measure each group's changes in

performance. Results from a two-tailed paired-sample *t*-test, based on the CTPA pre- and post-test scores, showed no significant change in critical thinking skills occurred within the CEA group, $t(17) = 1.093$, $p > 0.05$). The CEA group's mean (with standard deviations in parentheses) CTPA pre-test score was 30.22 (2.65), while the mean CTPA post-test score was 29.50 (2.18). This represents a mean score decrease of 0.72. Results from a two-tailed paired sample *t*-test, based on the CTPA pre- and post-test scores, also showed no significant change in critical thinking skills occurred within the Scaffolding group, $t(17) = 0.98$, $p > 0.05$). The Scaffolding group's mean (with standard deviations in parentheses) CTPA pre-test score was 26.83 (7.46), while the mean CTPA post-test score was 25.89 (7.15). This represents a mean score decrease of 0.94. As mentioned earlier, t-tests were also performed on the W-GCTA scores for both groups.

Results from a two-tailed paired-sample *t*-test, based on the W-GCTA pre- and post-test scores, showed no significant change occurred in critical thinking skills within the CEA group, $t(17) = 0.29$, $p > 0.05$). The CEA group's mean (with standard deviations in parentheses) W-GCTA pre-test score was 51.61 (6.83), while the mean W-GCTA post-test score was 52.28 (5.30). This represents a mean score increase of 0.67. Results from a two-tailed paired-sample *t*-test, based on W-GCTA pre- and post-test scores, showed a significant change in critical thinking skills within the Scaffolding group, $t(17) = 2.43$, $p < 0.05$). The Scaffolding group's mean (with standard deviations in parentheses) W-GCTA pre-test score was 51.72 (6.18), while the mean W-GCTA post-test score was 48.06 (6.42). This represents a mean score decrease of 3.67. Table 4.1 provides a summary of all means and standard deviations.

Table 4.1: Means and Standard Deviations Summary for CEA and Scaffolding Groups

Group	Baseline	Pre-Test		Post-Test		Adjusted Means	
	CTPA	CTPA	W-GCTA	CTPA	W-GCTA	CTPA	W-GCTA
CEA (n = 18)		M = 30.22 SD = 2.65	M = 51.61 SD = 6.83	M = 29.50 SD = 2.18	M = 52.28 SD = 5.30	M = 28.23	M = 52.30 (b)
SCAFFOLDING (n = 18)		M = 26.83 SD = 7.46	M = 51.72 (a) SD = 6.18	M = 25.89 SD = 7.15	M = 48.06 (a) SD = 6.42	M = 27.16	M = 48.03 (b)
BOTH GROUPS COMBINED (n = 36)	M = 29.17 SD = 5.72	M = 28.53 SD = 5.78					

Note. (a) = $p < 0.05$, using a paired-sample t-test; (b) = $p < 0.05$, using Analysis of Covariance (Post-Test = DV; Pre-Test = Covariate)

Evidence of Learning Transfer

As mentioned in Chapter 3, participants in the CEA group were asked to write a one-page journal entry reflecting on how they used the Building Blocks and Tools taught during the intervention in their other university courses and activities. Twelve out of the eighteen participants (66.67%) in the CEA group completed journal entries. Discourse (content) analysis was performed to count the frequency of occurrences, across all journal entries, of key characteristics of learning transfer, based on elements of the CEA approach that facilitate transfer. Table 4.2 summarizes the frequency of occurrences by characteristic, and Table 4.3 summarizes the percentage of participants who indicated transfer in their journal entries by characteristic.

Table 4.2: Summary of Characteristic Occurrences

Characteristic Description	Frequency
Naming of Specific Building Blocks and/or Tools	36
Sharing of Personal Relevance with specific Building Block and/or Tool Label	20
Sharing of Personal Relevance without specific Building Block and/or Tool Label	23
Description of Personal Strategy in Various Setting Types	6
Self-Evaluation	9

Table 4.3: Percentage Summary of Participants Responses by Characteristic

Characteristic Description	Percentage of Responding Participants
Naming of Specific Building Blocks and/or Tools	83.33%
Sharing of Personal Relevance with specific Building Block and/or Tool Label	75.00%
Sharing of Personal Relevance without specific Building Block and/or Tool Label	83.33%
Description of Personal Strategy in Various Setting Types	41.67%
Self-Evaluation	50.00%

Labeling and Personal Relevance

As mentioned in earlier, the Building Blocks of Thinking and Tools of Learning provide a common vocabulary for use by both the teacher/facilitator and learners. Most participants (83.33%) who completed journal entries named specific Building Blocks and/or Tools in those narratives. Although this is important, it is more important for learners to identify and share the personal relevance of the Building Blocks and/or Tools. A clear majority of these participants (75.00%) shared their personal relevance using the specific labels of various Building Blocks and/or Tools. For example, in discussing the Building Block, *Precision and Accuracy*, one participant shared, "Because I am majoring in biochemistry, I know that the world of science depends on correct information. I try to be precise and accurate in everything I do." Another participant shared that the Building Block, *Making Comparisons*, "helps us compare thoughts and actions with expectations to help us thinking twice about the assumptions we make daily."

Some participants shared personal relevance either about the Building Blocks and Tools generally, or by describing the Building Block and/or Tool rather than use the specific label. For example, in speaking generally about the Building Blocks and Tools, one participant noted, "I am grateful that I was exposed to this type of information because it not only helps to prevent me from 'jumping to conclusions' but I thinking about situations and the various ways that you can handle a situation positively." Or, as one participant shared, "It is through the inception of these building blocks of thinking and tools of learning that have made me an all around better critical thinker." Another participant in discussing the relevance of the Tool, Self-Development, shares, "I have had

a problem with coming to terms with my strengths and weaknesses, but I am learning to accept both [of] them and I know when to ask for help now."

Personal Strategies and Self-Evaluation

The final two characteristics explored in this study providing evidence of learning transfer is the description of personal strategies and self-evaluation. These are characteristics that become stronger with experience; however, some participants described personal strategies that they have developed from their work with the Building Blocks and Tools, and some participants were able to provide some description of how they evaluate their ability to use the Building Blocks and Tools. One participant shared that when approaching a situation, "I must first consider what should be my main priority." Another participant said, they "try to make a conscious effort to get more information about whatever problem I am dealing with before I start assuming things." In regards to self-evaluation, one participant said, "In my opinion, on a scale of one to ten, I would give myself an eight on my critical thinking skills." They go on to say, "One improvement I could probably make is to not make assumptions about so many things." Another participants notes, "I haven't started using the Tools effectively yet, but I am now trying to use them because I feel that they can be very helpful."

Based on the CEA approach, the five characteristics identified provided evidence of learning transfer, and all of the participants who completed journal entries indicated evidence of transfer.

CHAPTER FIVE:

DISCUSSION

The purpose of this study was to compare the effectiveness of a Scaffolding approach and the Cognitive Enrichment Advantage (CEA) approach in enhancing critical thinking skills in first-year university freshman. Five research questions were explored in this study. First, is there a significant difference in critical thinking after direct instruction of the components of critical thinking to all participants, based on baseline and pre-intervention scores from critical thinking performance assessments administered? Second, are there significant differences in critical thinking between university freshman randomly assigned to class sessions where the modified CEA approach was used with one group, and the Scaffolding approach was used with another group, based on pre- and post-intervention scores from the Watson-Glaser Critical Thinking Appraisal (W-GCTA) and critical thinking performance assessments? Third, are there significant differences in critical thinking, based on pre- and post-intervention scores from the W-GCTA and critical thinking performance assessments, within the CEA group? Fourth, are there significant differences in critical thinking, based on pre- and post-intervention scores from the W-GCTA and critical thinking performance assessments, within the Scaffolding group? And finally, based on reflective journal entries, to what extent do the participants in the CEA group indicate transfer of learning to other courses?

Based on this study's findings, as presented in the previous chapter, it is concluded that the Scaffolding intervention was not effective in enhancing the critical thinking skills of this study's participants. A possible reason for this finding is the

Scaffolding approach's lack of success with diverse learning styles, which is supported by the findings of Pressley et al. (1996). In discussing the use of scaffolding in the classroom, Pressley et al. note, "The conclusion that what will work with any particular child may depend on the cause of their academic problems contrasts with the idea that scaffolding can be applied universally with success – that all that needs to occur is to provide hints and prompts within the student's zone of proximal development" (p. 143). Although Pressley and colleagues do not dispute the zone theory, they suggest that recent research has provided evidence that scaffolding alone does not meet the needs of all learners, but can be a useful tool within a larger intervention plan for improving and supporting student thinking.

Previous studies exploring the utility of the CEA approach have demonstrated positive results with both children and adult learners. When investigating the use of the CEA approach with student inmates in Canadian prison schools, Campbell (2000) found that inmates who had participated in an anger management program along with literacy classes using the CEA approach had notably fewer major and minor charges than those inmates in the comparison group who had only taken the anger management course. The inmates in the CEA class also noted that using the approach facilitated their growth as learners. Greenberg (2000a) found that students in classrooms where the CEA approach was fully implemented made greater improvement in academic performance than comparison groups on national norms, based on National Curve Equivalency (NCE) scores. The CEA group also showed significant decreases in the percentage of students scoring below average on standardized achievement tests.

Based on the findings in this study in regards to the CEA group, no clear conclusions can be made about the effectiveness of the CEA intervention with this study's participants. The CEA group showed no significant changes in their critical thinking performance. Because the scores from the W-GCTA showed a slight mean score increase as opposed to the Scaffolding group's significant decrease, the intervention seemed to support the maintenance of the participant's established critical thinking skills.

Time could be the major factor that influenced these findings. Due to this study's time constraints, a modified, condensed CEA intervention was employed. First of all, only 5 Building Blocks of Thinking (out of 12) and 5 Tools of Learning (out of 8) were introduced during the Intervention Phase. In a full CEA intervention, all Building Blocks and Tools would be introduced to the learners more than one time, unlike the modified CEA approach explored in this study where the Building Blocks and Tools were only introduced once. More importantly, in a full CEA intervention students would be given numerous opportunities to select and focus on the Building Blocks and/or Tools they found personally relevant. This opportunity was not given in this study's intervention. Findings from this study shows that although the CEA approach may be a viable approach for improving students' critical thinking skills, it is not a quick fix.

In a previous study, Machleit (1999) compared the effects of a graduated prompting approach (scaffolding) to a mediated learning approach (CEA) in enhancing working memory. The CEA approach used in this study included the introduction of only one Building Block of Thinking, *Working Memory*. Machleit found no significant difference between the two approaches in enhancing working memory with results demonstrating significant increases in scores for both groups. However, Machleit's

participants' receiving the CEA intervention (and not those in the graduated prompting group) improved significantly on a transfer task of written expression. This finding was similar to the findings in the present study.

Although no significant evidence was found to show the CEA intervention's utility in enhancing critical thinking skills in these participants, evidence was found, through reflective journal entries, of learning transfer to other experiences and settings. Imbedded in every reflective journal entry was at least one of the five characteristics, based on the CEA approach: (1) naming of specific Building Blocks and/or Tools, (2) sharing of personal relevance using the specific labels for the Building Blocks and/or Tools, (3) sharing of personal relevance without using the specific labels for the Building Blocks and/or Tools, (4) describing personal strategies used in various setting types, and (5) self-evaluation that provided evidence of learning transfer. As Halpern (1998) suggested, teaching critical thinking skills that transfer across domains should be the foundational focus of such instruction. Because the CEA approach has a major focus on learning transfer, unlike most approaches previously explored for improving critical thinking, further research should be conducted regarding use of this approach.

Because the CEA group participants in the present study showed evidence of learning transfer as did the participants in the CEA intervention in Machleit's study, this study's findings inspire an important question: Why did the participants in Machleit's study show significant improvement in working memory, while the participants in the current study showed no significant improvement in critical thinking? There are a few possible explanations for this finding. First, the children participating in Machleit's CEA intervention could have been more malleable than the adult participants in this study's

CEA intervention. Second, Machleit's study utilized a one-on-one CEA intervention, whereas the CEA intervention in the present study was a group intervention. Third, the teacher/mediator in Machleit's study had over 10 years of experience with mediated learning. The teacher/mediator in the present study had considerably less experience.

Findings from the CTPA results were of particular interest in this study. Because participants in both groups engaged in practice responding to scenarios on worksheets throughout the intervention similar to those encountered in the CTPA exercises, it was expected that this assessment instrument would show more positive results. Instead, both groups showed non-significant decreases in mean scores. A possible explanation for the lack of significant findings from the CTPA was the participants' lack of personal connection to the assessment scenarios. For example, some of the CTPA exercises focused on historical events that occurred prior to the participants' birth; whereas, the scenarios encountered on the practice worksheets were closely related to the participants' everyday experiences, providing foundational knowledge to assist in providing solutions to various situations. Although Halpern (1998) makes an important point regarding transferability being the goal of critical thinking instruction, future studies should use performance assessment exercises more similar to those encountered during the intervention, along with assessment tools that assess critical thinking skills in a broader manner, providing the opportunity for assessing transferability.

Critical Thinking Skills versus the Disposition for Critical Thinking

Many educators have taken on the goal of promoting critical thinking in their classrooms; however, some have focused more on enhancing the critical thinking skills

and ignored the focus on enhancing their students' disposition for thinking in this manner. Can an individual have a high level of critical thinking skills, yet lack the disposition for critical thinking and vice versa? I believe so. The disposition to think critically is as important as having the skills or mechanics to do so. As Halpern (1998) shares:

> *"It is important to separate the disposition or willingness to think critically from the ability to think critically. Some people may have excellent critical-thinking skills and may recognize when the skills are needed, but they also may choose not to engage in the effortful process of using them. This is the distinction between what people can do and what they actually do in real-world contexts. It is of no value to teach students the skills of critical thinking if they do not use them. Good instructional programs help learners decide when to make the necessary mental investment in critical thinking and when a problem or argument is not worth the effort" (p. 452).*

An interesting finding in this study was the differences between the CEA group and Scaffolding group W-GCTA pre-test standard deviations. There was much more variability within the Scaffolding group scores in comparison to the CEA group scores, even though matched pairs were randomly assigned to these groups. This could point to an issue of disposition rather than an issue of critical thinking skills. It is not clear from the findings in this study; however, it is a question worth exploring in future studies. Most approaches focus completely on attempting to teach critical thinking skills; however, they have very little focus on attempting to improve students' disposition or willingness to use these skills in their everyday-life situations. More research should

focus on the relationship between critical thinking skills and the disposition for critical thinking.

Perspectives on Intervention Research

As many researchers have suggested in the literature, a host of problems can be associated with conducting intervention research (Fleischner, 1996; Gresham, MacMillan, Beebe-Frankenberger, & Bocian, 2000; Hester, 2003; McMillan, 1987; Shapiro, 1987; Tunmer, Chapman, Greaney, & Prochnow, 2002), including time constraints and environmental interferences that are inevitable in applied settings. When considering the effectiveness of any educational intervention, Tumner et al. suggested that the researcher must ask, "...was the frequency of lessons, average instructional time of each lesson, and overall duration of the intervention sufficient to produce positive effects in the skills that were the focus of the programme" (p. 19)?

Gresham et al. (2000) suggested there is a relationship between the complexity of a treatment and the amount of time required for its implementation. They add "complex treatments usually require more time to implement than simple treatments" (p. 201). The CEA intervention implemented in this study was a very complex one, and should be explored employing a longer intervention period in future studies. Gresham et al. also cited deviations from treatment integrity as a major issue to be faced when conducting intervention research. They suggested, "It should be noted that 100% or perfect integrity of treatments may not be required to produce effective results" (p. 202-203). In any mediated learning approach like CEA, the focus is on meeting the needs of the learners. In doing that, the teacher/mediator's pre-determined plans may be altered. In order to

keep the treatment as standard as possible in this study, treatment integrity was strictly maintained (99%). According to Gresham et al., focusing on maintaining high treatment integrity sometimes negatively affects the success of some educational interventions.

Finally, Fleishner suggested one of the major dilemmas researchers face when conducting intervention studies is "maintaining enthusiasm for the intervention without promising effects that have not yet been demonstrated" (p. 53). For Fleischner, it is important to continue to explore promising interventions, even when evidence for their promise has not yet been presented in the literature. Both McMillan (1987) and Hester (2003) suggest that interventions being studied in applied settings almost never show promising evidence in an initial study, so subsequent studies are always needed to really show the promise of an intervention. A follow-up to the present study is already in the planning stages in order to further explore the utility of both the Cognitive Enrichment Advantage and Scaffolding approaches in regards to the enhancement of critical thinking skills in university students.

Comparison of Present Study to Previous Studies

There are a few previous studies which explored approaches to improving critical thinking that are similar to the two interventions explored in the present study which should be noted in this chapter. Baker and Anderson (1983) compared the effectiveness of the structured inquiry, focused inquiry, and open-ended inquiry approaches in improving critical thinking skills in students enrolled in a sociology course. The Scaffolding approach in the present study included features of both the structured inquiry and focused inquiry methods explored in Baker and Anderson's study. The Scaffolding

intervention took a structured, guided approach to the critical thinking process, while focusing attention on specific situations each session that were related to the given topic area for that particular class session. The CEA intervention, in contrast, included features of all three of the approaches explored by Baker and Anderson. Like the Scaffolding intervention, the CEA intervention included both structure and content focus. However, the CEA approach like Baker and Anderson's open-ended inquiry approach encouraged learners to become personally engaged in the critical thinking process in order to gain more understanding about their personal strengths and weaknesses within the process to further improvement and development of their critical thinking skills.

In Baker and Anderson's study, the structured inquiry method produced the most improvement in critical thinking skills. In the present study, the Scaffolding intervention, a structured, guided approach, produced no improvement in the study group's critical thinking skills. Instead, participants in the Scaffolding group showed a significant decrease in critical thinking skills. It is important to note that the present study focused on assessing broad critical thinking skills, while Baker and Anderson's study assessed critical thinking as it relates directly to solving social problems. R. L. Williams (personal communication, February 19, 2004) suggest that studies have shown that it is more difficult to show changes in critical thinking using assessment tools like the Watson-Glaser Critical Thinking Assessment, which is designed to evaluate critical thinking in a broader manner, than it is when using assessment tools, such as the Psychological Critical Thinking Test, which is designed to assess critical thinking skills within the framework of a given the field, in the case of this instrument, the field of psychology.

Tien and Stacy (1996) investigated three instructional environments for furthering critical reasoning in a science course: (1) a traditional, laboratory environment, (2) a guided inquiry environment, and (3) a special course for non-science majors that focused on critical reasoning. The three interventions explored in Tien and Stacy's study lasted for one semester, simultaneously. In contrast, the intervention period in the present study lasted five weeks. Both the CEA and Scaffolding interventions in this study included aspects of the guided inquiry environment and the critical reasoning course. Like the guided inquiry environment, modeling and scaffolding were used within the class sessions, and like the critical reasoning course, learners were provided opportunities to apply the knowledge gained in the course to everyday situations. The CEA intervention went a step further than the Scaffolding intervention. In the CEA approach, participants were encouraged and challenged to go beyond the classroom experience, and consider how they could apply knowledge learned in the class sessions to other university-related and non-university related settings and situations. In Tien and Stacy's study, participants' critical thinking skills were assessed based on their ability to explain certain scientific procedures and evaluate fabricated studies, offering suggestions for improvement. They found that participants in the critical reasoning course outperformed participants in both the guided inquiry and traditional, laboratory environments. In the present study, findings based on both assessment tools indicated the CEA intervention helped the learners retain their level of critical thinking skills.

Davidson and Dunham (1996) investigated changes in critical thinking skills through the implementation of a two-year intervention. They studied effects of a seminar for Japanese students enrolled in an English as a Second Language (ESL) course at a

two-year women's college in Japan. In this study, they compared students in a control group who received English instruction with no focus on critical thinking to students in a treatment group who received English instruction and participated in a special seminar where students were taught information related to critical thinking through direct instruction and participated in discussions, which included "in-depth analysis and expression concerning subjects significant in their own lives and in Japanese society" (p. 5). Like Davidson and Dunham's study, the present study utilized a direct instruction approach to teaching critical thinking during the Pre-Intervention Phase; however, the present study did not include this type of discussion found within their critical thinking seminar during the direct instruction phase, nor the Scaffolding intervention. The CEA intervention, however, did include discussions where both the facilitator and the group participants shared personal situations where they had to use their critical thinking skills. Findings in Davidson and Durham's study, based on assessment using the Ennis-Weir Critical Thinking Essay Test, indicated that the treatment group performed significantly better than the control group. Their findings suggest a need for a significantly longer intervention than in the current study. It also suggests the importance of the focus on personal relevance within critical thinking related instruction.

Implications and Recommendations for Future Research

Pintrich (2002) suggests that more and more students are entering institutions of higher learning lacking critical thinking skills, which are important to academic success. As Williams and Worth (2001) found, critical thinking is a predictive factor for college success; however, it is a construct that appears difficult to improve, especially when

assessment is done with instruments designed to measure critical thinking in a broad sense. Most of the previous studies showing positive gains in critical thinking utilized assessment tools that challenged participants to respond to situations within the realm of specific content areas or fields of study.

Understanding gained from comparing both the Scaffolding and CEA approaches have helped provide further direction for future research. The present study provides a good foundation for further exploration of the use of the CEA approach as a possible intervention for improving critical thinking in college/university students. This study also provided interesting findings in regards to the utility of the Scaffolding approach. Because some approaches to the scaffolding have been shown to be an effective method for improving critical thinking skills, it was expected that this intervention would, at a minimum, show no significant improvements. Instead, this study's Scaffolding intervention produced a significant decrease in this study's participants' critical thinking skills.

This study suggests several changes for future research regarding these interventions for improving critical thinking. A research study employing a longer intervention period is recommended to provide further evidence about the utility of the CEA approach in enhancing the critical thinking of college freshman. As mentioned earlier, a follow-up study is in the planning stages to explore the experiences of participants in both groups in order to gain a better understanding of the strengths and weaknesses of both interventions, from the perspective of the participants. This follow-up study will also focus on exploring signs of learning transfer for both groups after being

removed from the study setting for over 15 weeks through both qualitative (reflective narratives) and quantitative (GPA comparisons) approaches.

Conclusions

Based on the findings in this study, it is concluded that the Scaffolding intervention was not effective in enhancing the critical thinking skills in this study's participants. Although this study did not yield any significant evidence showing the effectiveness of the CEA approach in enhancing critical thinking skills, it is concluded that the CEA intervention may be a viable approach for improving critical thinking skills in college freshman. More studies are needed, however, that employ longer intervention periods, and also utilize facilitators with substantial experience in using the CEA intervention. The CEA intervention did show effectiveness in facilitating learning transfer, which as Halpern (1998) notes should be the focus of critical thinking instruction.

When conducting intervention research, several issues must be faced during the conceptualization and planning phases of the study. Time is an element that must be taken into consideration when conducting intervention research (Tumner et al., 2002). More specifically, researchers must keep in mind that more complex interventions require more time for implementation. Greshman et al. (2000) warns against focusing too much on maintaining perfect treatment integrity, because this focus could hurt the intervention's possibilities for success. Finally, even when studies do not yield very promising results, researchers conducting intervention research must stay the course, and

maintain enthusiasm for continued research in order to fairly explore the interventions promise (Fleishner, 1996).

The recommendations and plans for future studies mentioned earlier will assist in providing new perspectives and questions regarding the use of the CEA and Scaffolding approaches for enhancing critical thinking skills, while also offering the possibility of adding new perspectives to the present body of literature around the worthy goal of improving the critical thinking skills of our learners. If one agrees with Pintrich's (2002) notion, facilitating improvement in our students' critical thinking skills should be the goal of every educator.

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APPENDICES

(Appendix A)

SAMPLE EMPLOYMENT-RELATED CRITICAL THINKING PERFORMANCE ASSESSMENT EXERCISE

Waiter/Waitress

- $2.75- 6.50/hr. plus tips which may be many times salary
- 30 hours/week
- Medical and Dental Insurance
- One or more meals/day
- Uniforms and laundry provided
- Involves lifting/carrying heavy trays
- May involve nights, weekends, holidays

Food Market Checker

- $5.00 - 10.00/hr
- 40 hours/week
- Medical and Dental Insurance
- Paid holidays, vacations, sick leave
- Involves standing all day
- Possible irregular work hours
- Limited opportunity for advancement

Refer to the job ads to answer the following question.

Sylvia is a single mother with two children, ages 2 and 5. Which of these two jobs would be more appropriate for her? Why?

SAMPLE HISTORICAL
CRTICAL THINKING PERFORMANCE ASSESSMENT EXERCISE

WASHINGTON — Legislation setting a uniform poll-closing time for presidential elections was approved Wednesday by the House .

The legislation is aimed at preventing West Coast voters from learning the projected outcome of presidential elections before polls in their states close.

Presently, West Coast polls close three hours after East Coast polls. Early results from East Coast cities can affect voters on the West Coast. West Coast voters may not go to the polls if they think that the election has already been decided. If polls close at the same time across the U.S., East Coast results will not be shown on national television before West Coast polls close.

Use the news article to answer this question.

If polls closed at the same time across the U.S., would more or fewer people vote? Why?

(APPENDIX B)

INFORMED CONSENT FORM

Dear Prospective Participant:

As a student in this course, you are invited to participate in a study, which will explore the use of the different teaching approaches in freshman seminar courses. By participating in this study, you will be basically asked to allow the researcher to use information collected from the activities and assignments that you will complete as a part of this course's curriculum during each week's class sessions.

Risks

There are no risks expected in this study.

Benefits

By participating in this study, you will have the opportunity to learn more about your abilities as a learner through participating in an alternative approach to learning.

Confidentiality

The records of this study will be kept strictly confidential. All data will be securely stored, and will only be made available to the researcher and the supervising faculty member. No references, in written or oral reports, will be made which could link participants to the study.

Contact Information

If you have questions at any time about the study or the procedures, you may contact the researcher, Vernon J. Hurte, at Room 204 in the Black Cultural Center, and (865) 974-4746. You may also contact the research supervisor, Dr. Katherine Greenberg, in Claxton Room A517, and (865) 974-4157. If you have questions about your rights as a participant, contact **Research Compliance Services** of the Office of Research at (865) 974-3466.

Participation

Your participation in this study is completely voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at anytime without penalty and without loss of benefits to which you are otherwise entitled.

If you withdraw from the study before data collection is completed your data will be destroyed.

Consent

I have read the above information. I have received a copy of this form. I agree to participate in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

(Appendix C)

Direct Instruction Worksheet

DIRECTIONS: **READ THE SCENARIO BELOW, AND RESPOND TO THE QUESTIONS.**

Last year, Susan was approved for two credit cards. Each card has credit limits of $2,000. Within the last year, Susan used both cards, reaching the maximum credit limit for each. Yesterday, Susan received notice that she is being terminated, and will receive her last paycheck in two weeks. What should Susan do regarding her credit cards? Why?

(Appendix D)

Scaffolding Worksheet

Directions: Read the following scenario, and respond to the questions below.

Reggie is a freshman at UT. He was recently invited to the International House for a Middle Eastern festival. Since the 9/11 attacks, Reggie has noticed that he has a stronger preference for hanging with a more homogeneous crowd? What should Reggie do about the festival? Why?

(6) Write 2 tentative solutions to the first question.

***** Hint: Think about the facts and what you can assume *****

(2) List 1 to 3 problems related to one or both of your solutions above.

***** Hint: Think about some doubts you discovered your solution *****

(3) Record some details about each problem listed above.

*** Hint: Think about what you may be taking for granted in your solution or in your problem ***

(4) Write a draft explanation for each tentative solution.

*** Hint: Use the problems you identified about some statements that lead to your conclusion ***

(5) Place a "star" beside the explanation above that you think is the best.

*** Hint: Think about whether your explanation is important and whether it is really related to the conclusion ***

(6) Write your final conclusion below.

(Appendix E)

SCAFFOLDING PROMPTS AND CUES

(1) Write 2 tentative solutions to the first question.

1st – "Think about the facts and what you can assume."

2nd – "Based on the fact or assumed fact, I would think she/he could…"
or
"Yes, your response is based on observed (and/or) assumed facts."

(2) List 1-3 problems related to one or both of your solutions.

1st – "Think about some doubts you notice about your response."

2nd – "You have (have not) stated some important doubts about your response."

(3) Record some details about the possible problem.

1st – "State some details about the possible problems"

2nd – "Think about what you may be taking for granted in your response or in your problem."

3rd – "The details you provided do (do not) focus on assumptions."
or
"I think _____ might be assumed here."

(4) Write a draft explanation for each tentative solution.

1st – "Use the problems you identified to think about some statements that lead to your conclusion."

2nd – "You have (not) provided some clear statements that lead to your conclusion."
or
"Because (premise) or (another premise), I think _____ is a good conclusion."

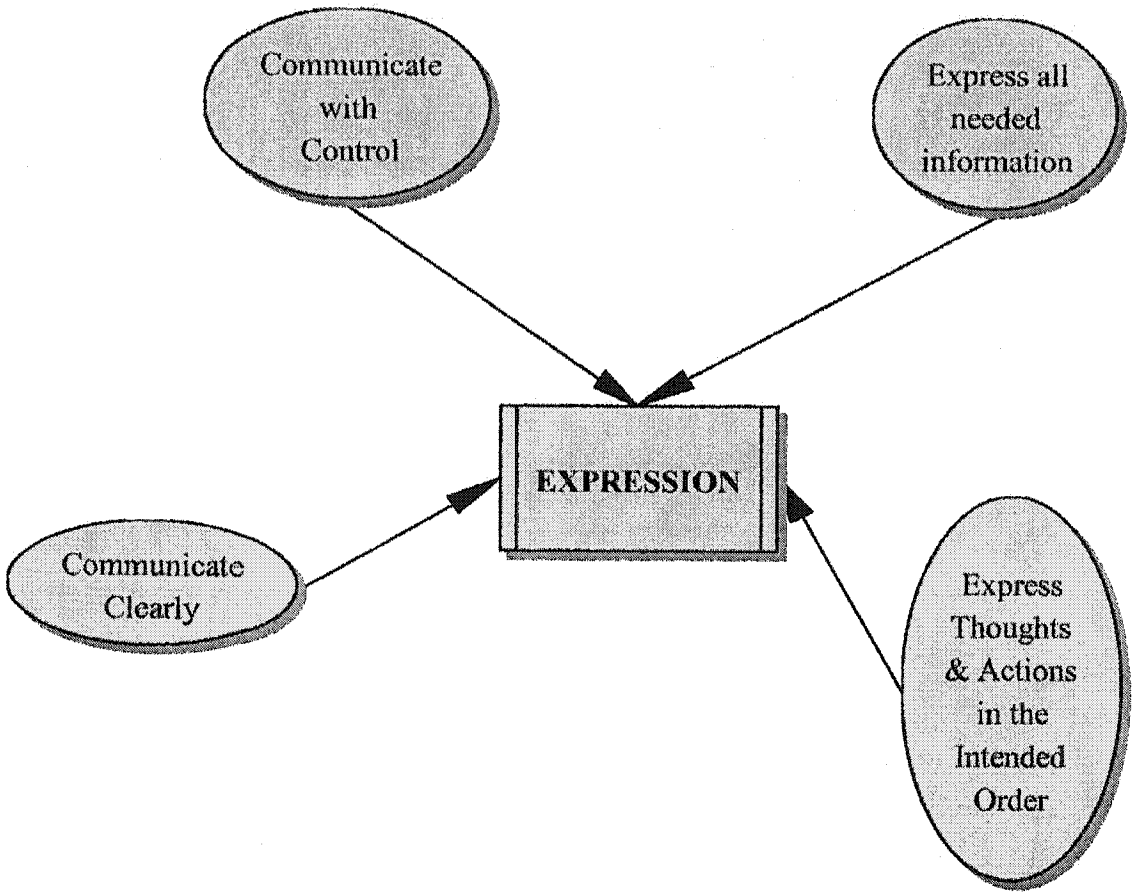
(5) Place a "star" beside the explanation above that you think is best.

1st ___ "Think about whether your explanation is important and whether it is really related to the conclusion."

2nd ___ "Your explanation is (is not) important and is (is not) related to your conclusion."

(Appendix F)

Sample Essential Attribute Mindmap



(Appendix G)

CEA Building Blocks of Thinking

Building Blocks for Approaching the Learning Experience

Exploration	to search systematically for information needed in the learning experience
Planning	to prepare and use an organized approach in the learning experience
Expression	to communicate thoughts and actions carefully in the learning experience

Building Blocks for Making Meaning of the Learning Experience

Working Memory	to use memory processes effectively
Making Comparisons	to discover similarities and differences automatically among some parts of the learning experience
Getting the Main Idea	to identify the basic thought that holds related ideas together
Thought Integration	to combine pieces of information into complete thoughts and hold them while needed
Connecting Events	to find relationships among past, present, and future learning experiences automatically

Building Blocks for Confirming the Learning Experience

Precision and Accuracy	to know there is a need to understand words and concepts and use them correctly and to seek information automatically when the need arises
Space and Time Concepts	to understand and use information about space and time that is important in almost all learning
Selective Attention	to choose between relevant and irrelevant information and to focus on the information needed in the learning experience

Problem Identification	to experience a sense of imbalance automatically and define its cause when something interferes with successful learning

CEA TOOLS FOR LEARNING

Tools for Understanding Feelings within the Learning Experience

Inner Meaning	to seek deep, personal value in learning experiences that energizes thinking and behavior and leads to greater commitment and success
Feeling of Challenge	to energize learning in new and complex experiences by focusing on the learning process rather than fear and anxiety about a possible unsuccessful product
Awareness of Self-Change	to recognize and understand feelings related to personal growth and to learn to expect and welcome change and development
Feel of Competence	to energize feelings, thoughts, and behaviors by developing beliefs about being capable of learning and doing something effectively

Tools for Motivating Behavior within the Learning Experience

Self-Regulation	to reflect on thoughts and actions as they occur to energize, sustain, and direct behavior toward successful learning and doing
Goal Orientation	to take purposeful action in consistently setting, seeking, and reaching personal objectives
Self-Development	to appreciate special qualities in everyone and to enhance personal potential
Sharing Behavior	to energize life and learning for everyone by sharing thoughts and actions through effective interdependent learning skills

(Appendix H)

CEA Worksheet

Directions: Read the following scenario, and respond to the questions below.

Reggie is a freshman at UT. He was recently invited to the International House for a Middle Eastern festival. Since the 9/11 attacks, Reggie has noticed that he has a stronger preference for hanging with a more homogeneous crowd? What should Reggie do about the festival? Why?

(1) Using a Building Block or Tool, describe a personal strategy you would use to thinking critically about this situation and complete each item on the worksheet.

(2) Write 2 tentative solutions to the first question.

***** Hint: Think about the facts and what you can assume *****

(3) List 1 to 3 problems related to one or both of your solutions above.

***** Hint: Think about some doubts you discovered about your solution *****

(4) Record some details about each problem listed above.

***** Hint: Think about what you may be taking for granted in your solution or in your problem *****

(5) Write a draft explanation for each tentative solution.

*** Hint: Use the problems you identified to think about some statements that lead to your conclusion ***

(6) Place a "star" beside the explanation above that you think is the best.

***** Hint: Think about whether you explanation is important and whether it is really related to the conclusion *****

(7) Write your final conclusion below.

(8) Did you refine your answers to any questions? If so, how?

(Appendix I)

DATE: _____ GROUP: _____ OBSERVER: _____

TREATMENT INTEGRITY OBSERVATION CHECKLIST: WEEKS 3 – 7

Direct Instruction

___ Yes 1.1: Shows slides/transparencies of components of Critical Thinking

___ Yes 1.2: Orally shares this information about the components of Critical Thinking.

___ Yes 1.3: Re-states original information about the components of Critical Thinking in other words after telling students their answer is unacceptable.

___ Yes 1.4: Re-states original information in other words if an inappropriate answer is received.

___ Yes 1.5: Presents scenario on slide.

___ Yes 1.6: Provides time for individual recording of responses to the 2 questions on the worksheet.

___ Yes 1.7: Asks for responses to both questions from as many participants as possible depending upon time and/or types of responses.

___ Yes 1.8: Provides feedback on student performance to large group (and to individuals if questions are asked) by saying, "definitely on point" or "good answer" in response to correct answers.

___ Yes 1.9: Provides feedback on student performance to large group (and to individuals if questions are asked) by saying, "not quite" or "think about that some more" in response to incorrect answers.

Scaffolding

___ Yes 2.1: Models 6 steps of the expert strategy by doing a sample worksheet for the class.

___ Yes 2.2: Asks students to complete a 6-item worksheet.

___ Yes 2.3: Asks students for final responses on completed worksheets.

___ Yes 2.4: Asks students to share responses to 1 or more other worksheet items.

___ Yes 2.5: Provides pre-planned prompts and cues if partners are asked to revise their responses **(See Attached List)**.

___ Yes 2.6: Provides positive descriptive feedback, by saying, "I see you're using the expert strategy." (as needed).

___ Yes 2.7: Tells before asking students questions related to critical thinking and the expert strategy.

___ Yes 2.8: Assigns 6-item worksheet related to reading material for class session to be completed with partners outside of session, and discussed at the next week's session.

CEA

___ Yes 3.1: Shares own meaning for critical thinking by relating personal experiences and stating clearly where critical thinking helped or would have helped, as related to class content for that session.

___ Yes 3.2: Asks for 1 to 3 examples from students of their use of critical thinking related to the class content.

___ Yes 3.3: Creates mindmaps with students, first recording student ideas related to a given Building Block or Tool.

___ Yes 3.4: Highlights essential attributes of the Building Block or Tool on a slide/transparency.

___ Yes 3.5: Reviews 6 steps of the expert strategy with students, relating steps to a Building Block or Tool.

___ Yes 3.6: Asks students to share 1 or 2 examples of a personal strategy that applies a Building Block or Tool for use in one or more steps, providing examples if needed.

___ Yes 3.7: Involves students in completing an 8-item worksheet as a large group.

___ Yes 3.8: Asks questions of students regarding each item, and its hint, as all students work together on the 8-item worksheet.

___ Yes 3.9: Asks students to share and justify personal strategies using a Building Block or Tool to complete each item.

___ Yes 3.10: Encourages students to provide feedback to their colleagues.

___ Yes 3.11: Provides descriptive feedback, pointing out how students did or did not use some part of the expert strategy.

___ Yes 3.12: Provides descriptive feedback, pointing out how a personal Building Block or Tool strategy helped them or would have helped them.

___ Yes 3.13: Asks students to self-evaluate by rating their responses.

___ Yes 3.14: Students explain their level of success based on use of steps of critical thinking, hints, and strategies based on strategies formed from a Building Block or Tool.

___ Yes 3.15: Generates bridging principles with students related to the use of a Building Block or Tool strategy for critical thinking.

___ Yes 3.16: Encourages students to develop examples to home, school, work, and/or social settings as related to the bridging principle.

___ Yes 3.17: Asks students before telling them something related to Building Blocks and Tools and Critical Thinking.

___ Yes 3.18: Assigns 8-item worksheet related to reading material for class session to be completed with partners outside of session, and discussed at the next week's session.

DATE: _____ **GROUP:** ____ OBSERVER: _____

TREATMENT INTEGRITY OBSERVATION CHECKLIST: WEEKS 8 – 10

Direct Instruction

___ Yes 1.1: Shows slides/transparencies of components of Critical Thinking

___ Yes 1.2: Orally shares this information about the components of Critical Thinking.

___ Yes 1.3: Re-states original information about the components of Critical Thinking in other words after telling students their answer is unacceptable.

___ Yes 1.4: Re-states original information in other words if an inappropriate answer is received.

___ Yes 1.5: Presents scenario on slide.

___ Yes 1.6: Provides time for individual recording of responses to the 2 questions on the worksheet.

___ Yes 1.7: Asks for responses to both questions from as many participants as possible depending upon time and/or types of responses.

___ Yes 1.8: Provides feedback on student performance to large group (and to individuals if questions are asked) by saying, "definitely on point" or "good answer" in response to correct answers.

___ Yes 1.9: Provides feedback on student performance to large group (and to individuals if questions are asked) by saying, "not quite" or "think about that some more" in response to incorrect answers.

Scaffolding

___ Yes 2.1: Asks partners for final responses on worksheets completed for homework.

___ Yes 2.2: Asks partners to share responses to 1 or more other worksheet items.

___ Yes 2.3: Provides pre-planned prompts and cues if partners are asked to revise their responses (**See Attached List**).

___ Yes 2.4: Provides positive descriptive feedback, by saying, "I see you're using the expert strategy." (as needed).

___ Yes 2.5: Tells before asking students questions related to critical thinking and the expert strategy.

___ Yes 2.6: Assigns 6-item worksheet related to reading material for class session to be completed with partners outside of session, and discussed at the next week's session.

CEA

___ Yes 3.1: Shares own meaning for critical thinking by relating personal experiences and stating clearly where critical thinking helped or would have helped, as related to class content for that session.

___ Yes 3.2: Asks for 1 to 3 examples from students of their use of critical thinking related to the class content.

___ Yes 3.3: Creates mindmaps with students, first recording student ideas related to a given Building Block or Tool.

___ Yes 3.4: Highlights essential attributes of the Building Block or Tool on a slide/transparency.

___ Yes 3.5: Asks students to share 1 or 2 examples of a personal strategy that applies a Building Block or Tool for use in one or more steps, providing examples if needed.

___ Yes 3.6: Leads large group discussion of worksheet completed by partners for homework, asking several partners to share their final response.

___ Yes 3.7: Asks questions of partners regarding various items, and their hints, on the completed worksheet.

___ Yes 3.8: Asks partners to share and justify personal strategies using a Building Block or Tool to complete the worksheet items.

___ Yes 3.9: Encourages students to provide feedback to their colleagues.

___ Yes 3.10: Provides descriptive feedback, pointing out how students did or did not use some part of the expert strategy.

___ Yes 3.11: Provides descriptive feedback, pointing out how a personal Building Block or Tool strategy helped them or would have helped them.

___ Yes 3.12: Asks students to self-evaluate by rating their responses.

___ Yes 3.13: Students explain their level of success based on use of steps of critical thinking, hints, and strategies based on strategies formed from a Building Block or Tool.

___ Yes 3.14: Generates bridging principles with students related to the use of a Building Block or Tool strategy for critical thinking.

___ Yes 3.15: Encourages students to develop examples to home, school, work, and/or social settings as related to the bridging principle.

___ Yes 3.16: Asks students before telling them something related to Building Blocks and Tools and Critical Thinking.

___ Yes 3.17: Assigns 8-item worksheet related to reading material for class session to be completed with partners outside of session, and discussed at the next week's session.

DATE: _____ GROUP: ____ OBSERVER: _____

TREATMENT INTEGRITY OBSERVATION CHECKLIST: WEEK 11

Direct Instruction

___ Yes 1.1: Shows slides/transparencies of components of Critical Thinking

___ Yes 1.2: Orally shares this information about the components of Critical Thinking.

___ Yes 1.3: Re-states original information about the components of Critical Thinking in other words after telling students their answer is unacceptable.

___ Yes 1.4: Re-states original information in other words if an inappropriate answer is received.

___ Yes 1.5: Presents scenario on slide.

___ Yes 1.6: Provides time for individual recording of responses to the 2 questions on the worksheet.

___ Yes 1.7: Asks for responses to both questions from as many participants as possible depending upon time and/or types of responses.

___ Yes 1.8: Provides feedback on student performance to large group (and to individuals if questions are asked) by saying, "definitely on point" or "good answer" in response to correct answers.

___ Yes 1.9: Provides feedback on student performance to large group (and to individuals if questions are asked) by saying, "not quite" or "think about that some more" in response to incorrect answers.

Scaffolding

___ Yes 2.1: Asks partners for final responses on worksheets completed for homework.

___ Yes 2.2: Asks partners to share responses to 1 or more other worksheet items.

___ Yes 2.3: Provides pre-planned prompts and cues if partners are asked to revise their responses **(See Attached List)**.

___ Yes 2.4: Provides positive descriptive feedback, by saying, "I see you're using the expert strategy." (as needed).

___ Yes 2.5: Tells before asking students questions related to critical thinking and the expert strategy.

CEA

___ Yes 3.1: Shares own meaning for critical thinking by relating personal experiences and stating clearly where critical thinking helped or would have helped, as related to class content for that session.

___ Yes 3.2: Asks for 1 to 3 examples from students of their use of critical thinking related to the class content.

___ Yes 3.3: Creates mindmaps with students, first recording student ideas related to a given Building Block or Tool.

___ Yes 3.4: Highlights essential attributes of the Building Block or Tool on a slide/transparency.

___ Yes 3.5: Asks students to share 1 or 2 examples of a personal strategy that applies a Building Block or Tool for use in one or more steps, providing examples if needed.

___ Yes 3.6: Leads large group discussion of worksheet completed by partners for homework, asking several partners to share their final response.

___ Yes 3.7: Asks questions of partners regarding various items, and their hints, on the completed worksheet.

___ Yes 3.8: Asks partners to share and justify personal strategies using a Building Block or Tool to complete the worksheet items.

___ Yes 3.9: Encourages students to provide feedback to their colleagues.

___ Yes 3.10: Provides descriptive feedback, pointing out how students did or did not use some part of the expert strategy.

___ Yes 3.11: Provides descriptive feedback, pointing out how a personal Building Block or Tool strategy helped them or would have helped them.

___ Yes 3.12: Asks students to self-evaluate by rating their responses.

____ Yes 3.13: Students explain their level of success based on use of steps of critical thinking, hints, and strategies based on strategies formed from a Building Block or Tool.

____ Yes 3.14: Generates bridging principles with students related to the use of a Building Block or Tool strategy for critical thinking.

____ Yes 3.15: Encourages students to develop examples to home, school, work, and/or social settings as related to the bridging principle.

____ Yes 3.16: Asks students before telling them something related to Building Blocks and Tools and Critical Thinking.

(Appendix J)

Critical Thinking Performance Assessment Scoring Rubric

Scorer: _____ **Participant Number:** _____

I. CONCLUSIONS/EXPLANATIONS

All conclusions/explanations logically follow beyond a reasonable doubt from the given information, if assumptions and inferences are accepted as correct.

3 = MOSTLY TRUE

2 = PARTIALLY TRUE

1 = MOSTLY FALSE

Exercise #1 Score _____ **Exercise #2 Score** _____

Exercise #3 Score _____ **Exercise #4 Score**_____

II. ASSUMPTIONS

Assumptions included in a conclusion or explanations are identified. Qualified by using terms such as: If, assuming, would probably, when, may, don't always, might, should, should probably, could, I Think, etc.

3 = ALL ASSUMPTIONS IDENTIFIED

2 = SOME, BUT NOT ALL ASSUMPTIONS IDENTIFIED

1 = NO ASSUMPTIONS IDENTIFIED

Exercise #1 Score _____ **Exercise #2 Score** _____

Exercise #3 Score _____ **Exercise #4 Score**_____

III. ALTERNATIVE CONCLUSIONS

Two or more additional conclusions are shared, regardless of their quality.

3 = MORE THAN TWO (2) CONCLUSIONS SHARED

2 = TWO (2) CONCLUSIONS SHARED

1 = ONE (1) CONCLUSION SHARED

Exercise #1 Score _____ **Exercise #2 Score** _____

Exercise #3 Score _____ **Exercise #4 Score**_____

IV. ALTERNATIVE EXPLANATIONS

Two or more additional explanations are shared, regardless of their quality.

3 = MORE THAN TWO (2) EXPLANATIONS SHARED

2 = TWO (2) EXPLANATIONS SHARED

1 = ONE (1) EXPLANATION SHARED

Exercise #1 Score _____ **Exercise #2 Score** _____

Exercise #3 Score _____ **Exercise #4 Score**_____

VITA

Vernon J. Hurte was born in Richmond, Virginia on January 13, 1979. A product of the Richmond Public School System, he graduated from Richmond Community High School with the Commonwealth of Virginia Advanced Studies Diploma in June 1997. Mr. Hurte went on to earn a full honors scholarship to Bowie State University. While at Bowie State, Mr. Hurte was a Ronald E. McNair Fellow, and was inducted into Psi Chi, the National Honor Society in Psychology. In 1998, Mr. Hurte was a visiting student in educational policy studies at the University of Cambridge, England. He was conferred the Bachelor of Science degree in Psychology, with distinction, from Bowie State in May 2001.

Mr. Hurte completed his Doctor of Philosophy degree in Education, with a specialization in Applied Educational Psychology, in May 2004. Presently, he is the Assistant Director of Multicultural Affairs at the College of William and Mary in Williamsburg, Virginia.