A Critical Thinking Module Evaluation

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Abstract

This study explores the process of developing critical thinking skills using the Edward de Bono CoRT (Cognitive Research Trust) Thinking Skill system. A qualitative research study approach was used with a class of high-achieving adult students enrolled at a Midwestern university in the US. The research focus was on the effectiveness of the CoRT-developed skills in assisting students with generating creative solutions. In this study of 20 first-year honors students, the researcher gathered data to evaluate the nature of the skill changes among participants. The use of the thinking skills in guiding and helping to generate ideas in a creative problem-solving project was assessed by a comparison of a 10-question pre- and post-instrument related to the thinking skills taught, examination of the student weekly assignments, in-class observations, and analysis of the final creative collaborative projects. An innovative approach of visual data analysis was used to compare the results of the findings beyond just content analysis. These results provide an in-depth understanding of this particular phenomenon with this unique group of students. Further study is recommended. However, these preliminary results suggest that university instructors can create positive changes in students’ critical thinking skills.

Keywords: creativity, problem solving, critical thinking skills, CoRT, first-year student, higher education, US, visual data analysis
1. Introduction

“There is not adequate theoretical recognition that all which the school can do for pupils, so far as their minds are concerned... is to develop their ability to think.”

John Dewey (Democracy and Education, 1916)

Creative problem solving and critical thinking are thought by many to be important skills. Learning them requires extensive work by the learners: but the lessons, while not conveying traditional content, will change the learners in ways they do not foresee and in ways not generally taught at the University, but in ways which are transformative. While universities look for first-year university students to be creative, instructors seldom work at developing those same skills. This qualitative research study explored the effectiveness of one process designed to develop these creative problem solving skills. The Edward de Bono CoRT (Cognitive Research Trust) thinking skill system is one well-known instructional methodology for developing creative thinking skills. Dr. deBono, who has authored over 80 books and coined the phrase lateral thinking, has implemented the CoRT method into school curricula in many countries. In this study of 20 first-year high achieving honors students, the researcher gathered data to evaluate the impact of teaching these skills on assisting students with the generation of creative solutions. Students answered ten questions in the form of an instrument designed for the CoRT process to measure the students’ critical thinking skills at the beginning of the class. The evaluation instrument was used again at the end of the course to compare students’ depth of change after training in the deBono methodology. The students’ actual use of these ten thinking skills in guiding them to generate ideas in a creative problem-solving project was also assessed by examining student assignments related to the thinking skills, in-class observations, and analyzing the final creative collaborative projects.

1.1 Problem Description

The failure to think critically is an obstacle for the students of today as they prepare to be tomorrow’s leaders. Too often students enter the university having achieved academic success by echoing the words of their instructors. First-year students at the university are often asked to explore new ideas, think critically, and re-invent the ways in which they think. The challenge for the individual student is that the process on how to think critically is seldom taught or valued at the university level. “The ability to think critically, which is mandatory to effecting transformation, is itself developmental: that is, we can become better, more critical thinkers” (Merriam, Caffarella, & Baumgartner, 2007, p. 147). This study focused on one process for teaching critical thinking skills within a course on creative problem solving. There is limited research
data on the implementation of the de Bono method with first-year university students. The additional analysis of the students’ ability to transfer these newly learned skills to creatively solve a societal problem was the focus of this study. In a world that values positive social change, the researcher felt that these results were important.

1.2 Research Question

This study looked at the results of teaching critical thinking within the context of a first-year class of 20 high achieving honor students. The question that the research study sought to answer centered on the impact of the teaching of deBono CoRT Thinking Skills for improving the critical thinking skills of this group of first-year university students.

2. Literature review

There exists a broad research foundation in the area of creativity. This literature review provides a brief overview of creativity. One key component of teaching creativity is the element of critical thinking and creative problem solving. A discussion of the research literature related to Edward deBono’s CoRT system (deBono, 1972) and its relationship to creativity is also explored.

2.1 Creativity

The study of creativity research began with the mathematician Henri Poincare’ (1854-1912) and led to Wallas’ (1926) formulation of a four-step Creative Problem Solving (CPS) process: preparation, incubation, illumination, and verification. In the 1950s American psychologists Torrance and Guilford began separately researching creativity and developing creativity tests that are still in use today. Koestler’s research in Europe during the same mid-century timeframe resulted in the publication of The Art of Creativity. Another key resource is Sternberg’s (1999) documentation of 50 years of research in the field of creativity (Vidal, 2009, p. 415).

One of the difficulties to discussing creativity is determining an agreed upon definition. ‘What is creativity? Among other things, it is the ability to challenge assumptions, recognize patterns, see in new ways, make connections, take risks, and seize upon chance’ (Hermann, 1996, p. 245). Another viewpoint is expressed by Hokanson:

... creativity can be recognized as the ability to generate a wide number of ideas addressing a given problem or stimulus [fluency]; it implies the ability to develop different types of ideas for any given instance [originality]; and also the ability to generate unexpected ideas [flexibility]. These three areas
are the main aspects of standardized tests of creativity developed by Dr. Paul Torrance, and are categorized as fluency, originality, and flexibility. (2007, p. 353)

Dr. Paul E. Torrance developed the most widely used standardized test of creativity: the Torrance Tests of Creative Thinking (TTCT) (Kaufman & Baer, 2006). The TTCT focuses on measuring fluency, originality, and flexibility.

For more than half a century Guilford has been writing on the connection between learning and creativity. He goes as far as stating that “creativity is the key to education in its fullest sense and to the solution of man’s most serious problems” (Guilford, 1967, p. 13). He finds it difficult to separate creativity from theories of learning. “A creative act is an instance of learning...a comprehensive learning theory must take into account both insight and creative activity” (1950, p. 446). Vidal urges teachers to integrate creativity into the curriculum. “There is a growing demand that educators all around Society enhance and adopt creativity in their teaching activities. Creativity is a way to cope with complexity” (Vidal, 2009, p. 430).

But creativity needs to be considered beyond the classroom. The corporate world is beginning to recognize the importance of creativity as a “key to greater productivity” (Cox, 2005, p. 2). New marketing opportunities and the growth of emerging technologies have increased the importance of creative solutions. “Creativity is the generation of new ideas—either new ways of looking at existing problems, or of seeing new opportunities, perhaps by exploiting emerging technologies or changes in markets” (p. 2). This idea is supported by Torrance’s creativity characteristics of originality and flexibility (1974).

Creativity can also be viewed through the lens of problem solving. “What constitutes creative thinking is certainly a matter of debate, but most agree that it involves originality, seeing problems in new and insightful ways, or finding a solution to what others did not recognize as a problem” (Driscoll, 2005, p. 363). The process of teaching critical thinking skills to creatively solve a problem is the focal point of the research study addressed by this paper.

2.2 Critical Thinking

Critical thinking is another way of defining creative problem solving. Vidal believes that “To be creative you have to be open to all alternatives” (2009, p. 413). Critical thinking and flexibility is an important component of creativity. “…the ability to switch between conventional and unconventional modes of thinking is important to creativity” (Sternberg R. J., 2006, p. 90). There is a historical precedent for intertwining the concepts of creativity and critical problem solving. Dewey’s model, from 1910,
...comprised stages of perceiving a difficulty, locating or defining a problem, suggesting possible solutions, elaborating implications of these solutions, and testing the validity of the solutions, is often cited as an early model of the creative process even though it was meant to describe problem solving in general. (Lubart, 2000-2001, p. 302)

Many times courses that focus on creativity are not taken seriously at the college level (Fasko, 2000-2001). The question explored by this study identifies one approach to teaching critical thinking skills. Vidal (2009) recommends the following considerations for effective teaching of creativity, with an embedded focus on problem solving:

• Introduce modern interdisciplinary concepts about creativity,
• Adopt creative tools and approaches that can be included in the problem solvers toolbox to complement the traditional hard and soft rational approaches, and
• Show how creativity methods can be used in the practice of problem solvers. (p. 430)

People make use of their critical and creative thinking skills to help them solve problems in the classroom and everyday life. Many researchers agree on the importance of teaching critical thinking skills as an essential component for developing creativity (Fasko, 2000-2001; Guilford, 1950; Vidal, 2009). One accepted approach to critical thinking is labeled divergent thinking…”the process of generating many alternative ideas” (Lubart, 2000-2001, p. 299). The divergent thinking process emphasizes that there is not one correct solution to a problem. Another more encompassing term is referred to as lateral thinking. For this study, the elements of lateral thinking that will be important are Torrance’s emphasis on flexibility with deBono’s focus on a change of perception by the participants.

Lateral thinking involves changing perceptions and flexibility. There is an overlap with creativity since both are concerned with producing something new, but lateral thinking is a more precise definition of the process of changing perceptions: changing the way we look at things. (CoRT Web Site, 2006, p. 1)

Lateral thinking is the foundation for deBono’s CoRT Thinking Skills system. For years, deBono has “articulated processes to arrive at creative solutions through sequential methods” (Jensen, 2000, p. 20). This system is in use in many school systems and countries worldwide. In this study, the researcher gathered data to evaluate the usefulness of these skills in helping students generate creative solutions. ”The CoRT Thinking Skills series (de Bono, 2000) contains six lesson sets (breadth, organization, interaction, creativity, information / feeling, and action) with the set of ten lessons on ‘breadth’ being the most foundational” (Goliath, 2006, p. 1). This study focused on the first lesson set: breadth.
3. The Research Study

This qualitative research study endeavored to determine the benefits of the CoRT Thinking Skills process for high-achieving first year college students. As part of the study, the students were asked to solve a problem using the critical thinking skills being taught during the course. Given the nature of the participants (95% White), students considered the bi-polar topic of the social issues of minority students. This topic had the added benefit of linking the social issue of minority recruiting and retention to the opportunity for a transformative learning experience. Jordan identified the benefit of linking educational equity considerations with transformative learning: “…educational equity in a global society is about providing transformative learning experiences for students who require such experiences for social mobility, as well as social and cultural reproduction for students already on top” (2010, p. 151). This article’s main focus is on the impact on the students’ critical thinking skills as a component of creative problem solving.

3.1 Methodology

A qualitative research approach for evaluating the depth of participant change during an instructional module that taught critical thinking skills was chosen. This study met the qualitative criteria by including a rich analysis and multiple sources of data to determine the depth of change experienced by the participants (Merriam, 1988; Yin, 2008).

A pre- and post-instrument from the CoRT Thinking Skills system was administered to the subjects to determine the depth of change in their responses to 10 questions that related to each of the 10 lessons that comprised the CoRT system. In addition, each week a minority-related discussion response was collected and stored for each individual student. Ten minority-related questions were developed that aligned to each of the 10 CoRT lessons introduced, one per week (ex. Week 4 - Lesson 4 - C&S: Consequences and Sequel - Imagine if all funding and support for minority recruitment and retention have been stopped at [the university]. Do a C&S on the results of this action). Data gathered during the semester included the above documents as well as in-class observations, researcher field notes, and final collaborative projects. All 20 students in the Creative Problem Solving freshman honors course participated in the research study.

Data from the pre- and post-instrument were entered into an electronic document by student code and question number. The researcher then used an open coding methodology (Strauss & Corbin, 1998) to categorize and encode the responses to determine recurring themes, patterns, and topics (Bogdan &
Biklen, 2003). The results of the data collection were viewed through the theoretical perspective of deBono’s Lateral Thinking definition of changing perceptions and flexibility (1985) and Torrance’s Creativity characteristics of fluency, flexibility, and originality (1974). Initial analysis indicated that the frequent items represented in the coded categories were the change of perspectives and fluency. The detailed analysis reported will focus on perspective and fluency.

One research tool used for visual date analysis was Wordle word clouds for comparing pre- and post-instrument responses. Wordle is a free Internet tool that creates word clouds from text and emphasizes words that appear more frequently in the source text. The word clouds were compared against the themes and ideas expressed in each of the pre- and post-responses to determine the differences to go beyond simple content analysis. The number of items identified and changes in perspectives noted were accurately reflected in most cases in the graphic representations. “Textual analysis is an area that tools like Wordle have revealed as especially suited to visual techniques” (New Media Consortium, 2010, p. 30). Examples of these word clouds are included in Figures 3 and 4.

3.2 Description of the Setting

This study took place in a first semester course for entering honors students in a mid-size Midwestern university. The 20 students had been selected by the university to receive financial support and recognition based on a rigorous screening process. The selected students came into the program after demonstrating high academic scores during their high school years. Each candidate had also passed an interview process that identified her or him as a potential leader with high academic success at the university level. Of the 20 students, eight were male and twelve were female. All but one were Caucasian and the majority were from rural communities. The one non-White student was self-identified as American Indian during the mid-point of the 16-week semester. The student population at this university is 86% White/Caucasian and 91% of the university workforce is identified as White/Caucasian. The university has emphasized minority recruitment and retention but the minority enrollment numbers remain low. The class met weekly for 2 hours in a class room in the College of Education.

3.3 The Researcher

As with any qualitative study, the researcher brings her own bias and perspective to the study (Merriam & Associates, 2002). Stake suggests that "standard qualitative designs call for the persons most responsible for interpretations to be in the field, making observations, exercising subjective
judgment, analyzing and synthesizing, all the while realizing their own consciousness” (1995, p. 41). As the instructor and researcher, I recognized that I brought my own expectations and bias into the study.

Transformative learning is the process that I, as the instructor and the researcher, expected to observe in the students studied. “Transformative...learning is about change—dramatic, fundamental change in the way we see ourselves and the world in which we live” (Merriam, Caffarella, & Baumgartner, 2007, p. 130). I was hoping for the demonstration of creative and innovative solutions as part of the students’ final collaborative projects. I was also hoping to see marked differences in the pre- and the post-instrument results. Throughout the semester I maintained an open dialogue with minority faculty and students to verify my understanding and instructional strategies in this sensitive area in order to recognize and reduce my own bias regarding the students’ final collaborative projects.

My role in the class was that of the instructor, whose task included introducing the weekly CoRT lesson at the beginning of each class. I encouraged students to participate in open discussions and attempted to limit any personal judgmental feedback or reactions to their contributions. My field notes existed in the form of a weekly journal. This tool allowed me to track my own personal growth and occasional frustrations during the course of the 16-week semester. My weekly journal of the students’ data results and in-class observations assisted me in gaining a richer level of understanding.

3.4 Instrument

The instrument used for the pre- and post-evaluation of the deBono CoRT Thinking Skills was developed by Dr. Audrey Rule, University of Northern Iowa, with assistance from the researcher. Each of the 10 instrument questions focused on one of the CoRT 10 lessons. Figure 1 lists all questions from the instrument.
The results of all responses to the instruments were placed into an electronic document and analyzed for patterns and recurring themes. At the time of the first administration of the instrument, no mention was made that it would be used as a post-evaluation tool. The same amount of time was provided for both the pre- and post-response. It was stated on both occasions, that the results would not affect the students’ course grade.

3.5 Procedures

The focus of the course that included the research study was on creative problem solving. Each week the students were asked to read and discuss an article on creativity and to complete an activity that involved doing something different. The activities were intended to ask the students to interact with their world in an innovative and challenging way. Examples included talking to someone outside their social circle, have a social interaction with a professor, or doing something beyond their previous experiences. For the last example, one honors student took the ultimate risk by not doing the assignment.

Each week the students were asked to concentrate on the week’s CoRT 1 Lesson (refer to Table 1). During the 2-hour weekly class session, students were introduced to the concept of the selected CoRT lesson for the week. The instructor followed the CoRT system of introducing the lesson with examples, asking for student examples, assigning students to small discussion groups, requesting group feedback, and then providing a summary of the lesson. This process normally was limited to the first 30 minutes of the class. The homework assignment was then assigned to apply the CoRT lesson of the week to a question determined by the instructor and related to minority issues.

The pre-instrument was administered by another faculty member the first class period. During the same session, students signed an agreement to participate or not to participate in the study. The results were sealed in an envelope and not given to the instructor (the researcher) until the end of the
semester after grades had been posted. The post-instrument was administered during the next to last session of class. No indication was given to the students during the first class that they would repeat completing the questionnaire at the end of the course. Both instrument results were typed and stored in spreadsheets after the end of the semester for later analysis and reporting. One of the tools used for comparing the instrument responses for the 10 questions was the use of a data visualization tool, http://wordle.net, for data analysis (The New Media Consortium, 2010). All pre- and corresponding post-instrument responses were used to create comparative word cloud graphics in order to allow a visual data comparison. The use of the word cloud comparison for content analysis was then aligned to the completed coding of the student responses to determine an alignment to a change of perspective and increased fluency.

4. Findings

The findings for this study focused on the results obtained from the pre-instrument data from the first day of class and post-instrument information. Additional data analysis included reviewing the student weekly task assignments, in-class observations, and the final collaborate projects. A discussion of the instrument analysis, additional artifact analysis, and summary of the findings follow. The researcher’s field notes were used to validate the reliability of the conclusions.

4.1 Instrument Analysis

The pre-instrument written responses were given to the instrument administrator and later transcribed into an electronic document. The post-instruments were again administered during the next to last class period with an additional eleventh question added to determine each student’s perceptions of the value of learning the CoRT lessons. Data were typed into an electronic format and later combined with the pre-instrument results for each student. For critical analysis of the responses, each question was entered into a separate document to determine categories, themes, and patterns. The types of responses by category were also tracked for frequency of recurring or new items. Besides student differences over time, overall differences in categories were determined. Data visualization for several of the responses was used to create word clouds to graphically determine key responses and differences (refer to Figures 3 and 4).

For the research study, all 10 questions with responses from the 20 students were analyzed. The findings were analyzed for patterns of change over the time of the semester and for the theoretical framework of change of perception
and flexibility (deBono, 1985) and fluency, originality, and flexibility (Torrance, 1974). The fluency comparison is provided in Figure 2. For a complete list of lesson descriptions, refer to Table 1 in the Appendix.

![Instrument Idea Comparison by Response (Fluency)](image)

[Figure 2] Fluency Chart of Idea Comparison

### 4.1.1 Change of Perspective

There was a change in the students’ perspective over the period of the course. The responses indicated an awareness developing among the students that went beyond their initial understanding. An example of this occurred during Lesson 4 (C&S: Consequences and Sequel: Question: 4. A breakthrough cure for Alzheimer's disease has been found that reverses all damage. What will happen as a result?). A comparison in the responses during week 4 aligns to deBono’s theoretical definition of lateral thinking. The change in perception is indicated in the responses and graphically supported in Figure 3. The emphasis on the disease of Alzheimer’s is replaced with concern for the people affected in the second image. An increase of fluency was also noted by the number of ideas increasing from 51 to 87 over the two instruments (refer to Figure 1). The following student instrument response
represents a change in his perspective. Pre-response: *This could strain the healthcare system and social security.* Post-response: *People will have the ability to learn through the experiences of their ancestors* (Student 2).

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<th>Pre-instrument Response to Question 4</th>
<th>Post-instrument Response to Question 4</th>
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<tr>
<td><img src="image1" alt="Alzheimer's memories" /></td>
<td><img src="image2" alt="Alzheimer's people" /></td>
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**[Figure 3] Pre and Post Responses to Instrument Question 4.**

### 4.1.2 Fluency

Increased fluency was evident in every post-response at the class level even though the same amount of time was given at the end of the semester to complete the questionnaire. Coding the results of the responses for Question 2 resulted in almost a doubling of the identified considerations (CAF: Consider All Factors - Question: 2. *There is a plan to locate a center for the homeless on campus. What should be considered in the final decision?*). Aligned with the Theory of Lateral Thinking in the area of fluency, the number of ideas generated between the pre- and post-instruments increased from 80 items to 122 items. A change in perspective from viewing the homeless as a threat to the potential effect this would have on the students and campus was noted. In the pre-response, eight students mentioned concerns of safety and of students being at risk while seven mentioned the need to have the location of the center to not be prominent. An example of this was the following pre-response: *Sectioning off students from the homeless needs to be a major focal point* (Student 19). The post-responses categories showed an increase in concern for the homeless and how they could be assimilated into campus life. A total of seven post-responses mentioned inclusion of the homeless: *How would the homeless people on campus relate to the students. How could volunteer organizations contribute to the center? Could the center be completely run by volunteer students? Could the classes in administration use the center as a part of the class?* (Student 8). The mention of the practical consideration for funding the proposed homeless center also increased from 3 pre-responses to 13 post-responses. The following post-response indicates a concern for funding and also indicates a shift in perspective that includes the safety of the
homeless and not the students: *I think the cost of the project, the safety of the students, and the safety of the homeless should all be considered.* (Student 15).

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<th>Pre-instrument Response to Question 2</th>
<th>Post-instrument Response to Question 2</th>
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[Figure 4] Pre and Post Responses to Instrument Question 2.

4.1.3. Instrument Analysis Summary

All of the pre- and post-instrument results were analyzed for recurring themes, patterns, and topics (Bogdan & Biklen, 2003). The resulting categories for each pre-response were than compared with each post-response to the instrument question. Word clouds were created for each response and visually compared for similarities and differences for a visual comparison to the textual analysis. The theoretical framework for the analysis was based on deBono’s Lateral Thinking theory and Torrance’s Creativity theory. The Lateral Thinking theory focuses on the learner’s ability to change perceptions and demonstrate flexibility (1985). Torrance’s definition of creativity identifies the three key factors as: fluency (the ability to generate a wide number of ideas addressing a given problem or stimulus), originality (the ability to develop different types of ideas for any given instance), and flexibility (the ability to generate unexpected ideas) (Hokanson, 2007).

The greatest increase demonstrated by the student responses were in the areas of change in perception and increase in fluency. However, there were significant changes in responses for all questions in these two areas. The characteristics of originality and flexibility were evident infrequently for a limited number of students. One interesting finding was the use of humor combined with originality for several of the instrument questions. Question 8 asked why a student might be attacked by crows: *Food in his/her hair. Trespassed on the crows territory and they are defending themselves. Aliens abducted the student and planted crow attracting radar in his head and put him back on campus* (Student 16).
4.2 Additional Artifact Analysis

Each week, answers to a minority-related discussion question were collected and stored for each individual student. Students did well in meeting the requirement to apply each thinking skill for a specific question. After completing the Lesson 2 task, Student 5 included the final comment: *I think the CAF [Consider All Factors] approach really helps you analyze the topic at hand. There are a lot of factors that one would completely overlook when making a statement until they really go in and see what would be affected, or how the people that it affects would feel. I personally still prefer the PMI [Plus, Minus, Interesting] method though, as it seems more organized to me. I like how there are categories, whereas CAF is more of just a list.*

Data gathered during the semester included the pre- and post-response documents as well as in-class observations, weekly assignments, and final collaborative projects. The in-class observations by the instructor reflected the students’ abilities to create a variety of unique responses (fluency) to given situations. As the semester progressed, the researcher observed that the students’ ability to work collaboratively increased and their comfort level discussing sensitive topics improved. The field notes documented the researcher’s repeated frustration at the students’ failure to obtain information for the collaborative project beyond their own experiences. Asking a predominantly White middle-class group of first-year students to understand the challenges of minority students proved to be beyond their limited perspectives. Students repeatedly failed to consult instructor-recommended resources on campus or to reach out to minority students. The final group projects were developed following the CoRT process and showed evidence of fluency but limited originality or flexibility. The analysis by the researcher resulted in the realization that the students were able to apply the critical thinking skills process to a specific problem but lacked an in-depth understanding of the problem related to minority issues. They failed to take the initiative to seek out additional information from outside sources.

5. Discussion

For the instructor, this was the second time for teaching this course. One of the student quotes from the first course evaluation included the following statement: *There are certain experiences in one’s life that are so profound they cause inner reflection and ultimately personal growth. In the presidential scholarship class, Creative Problem Solving, I was fortunate enough to be a part of such an event.* The positive experience of teaching the class in the past prompted the instructor to teach it a second time.
The addition of the CoRT process by the instructor was seen as potentially beneficial for this group of students. The specific purpose of the CoRT lessons is to broaden perception so that in any thinking situation we see beyond the obvious, immediate and egocentric. Experience has shown that students who have been through the lessons develop a much broader view of situations (deBono, 1985).

The research data was analyzed through the theoretical lens of Lateral Thinking and Creativity. The greatest gain in the post-instrument results, weekly tasks, and in analysis of the development of the final collaborative projects was evidence of fluency. The ideas that were identified increased over time as the students were provided critical thinking tools to work through a problem. What was evident was the change of perspective from being one that was egocentric to one that was more global. An example is where Question 8 were the students’ responses shifted from the disease of Alzheimer’s showing more concern on how the people would be affected by the elimination of the illness.

A final question was added to the post-instrument to solicit students’ reactions to their perceived value of the CoRT Lessons. All students felt that the activities had value. I feel that using the CoRT thinking skills are helpful. There are 10 ways to look at a problem/analyze a situation. Without them, I would simply try to devise a solution. With de Bono's thinking skills, I have 10 directions to take the problem I'm solving. I anticipate using them in the future (Student 14). The other extreme was Student 16 who stated: I think that the value that the thinking skills have is overrated. I feel that most of the conclusion and ideas I developed, I did through my natural way of thinking and not through the focus of any of the skills. I think they are good tools to use if a person needs them but not to be a basis of where a person's thinking starts. The majority of the students (70%) fell into the middle of these two ends: I see these skills as a new way to interpret problems, ideas and possible solutions. Instead of being just stumped, there is now an identified process to follow. Although it may not be applicable in all situations, it certainly can help in most. By combining different skills more solutions that are much more creative can be found (Student 9).

An additional consideration in analyzing this data was the make-up of the participants. The students were 95% White and all were dealing with the issues of adapting to the first semester in a university setting. These high achieving students had a history of being rewarded for responding with the expected answers to instructors and discouraged for taking academic risks. Many had limited exposure to a diverse student population and many came from communities of fewer than 300 residents.

6. Conclusions and Recommendations
As the instructor/researcher, I began the class with high expectations for the students during the course of the semester. The inclusion of the CoRT Thinking Skills lessons was intended to open the participants’ thinking in new ways that would result in a transformative learning experience for me and each student. My generalizations about the case have changed over time as a result of the completed in-depth data analysis. Many of the entering awkward and innocent youth spent the semester coming to terms with being at a university that placed high expectations on their potential successes. The semester ended with the learners successfully completing the tasks regarding learning the critical thinking skills.

This study documents that a change of perspective and increased fluency was repeatedly demonstrated from the pre- to the post-instrument responses. The learners’ ability to apply what they learned in a meaningful way to a campus problem seemed to lack the creative spark that was anticipated. However, the students did see value in the CoRT Thinking Skills process and wrote that they plan on using the critical thinking skills in the future. One student wrote of a personal transformative experience regarding his own creativity during the course: I thought the critical thinking skills were the most interesting part of the course. I enjoy learning about how the brain works and how to better utilize it. I came into the course with the idea that I am not creative, but now I would say I am very creative because my definition for creativity and how I quantify it has changed (Student 2).

An example of a change of perspective was demonstrated in participant responses to the first instrument question on peer grading of freshman. The pre-survey responses indicated three students who disagreed with the statement but eight who disagreed in the post-response. Categories of pre-instrument concern were for impact on self, the freshman, the professor, and reviewer. Post-responses included less of an emphasis on the effect to self and more on the negative aspects in selecting the reviewer (lack of expertise and objectivity rated the highest) was coded.

The study demonstrates that the teaching of the CoRT skills did have an additional impact on the fluency skills of the participants. The data provide in Figure 2 supports this conclusion. The presence of the remaining theoretical elements of originality and fluency were limited. Of greatest concern is the documented student ability to demonstrate the CoRT process without resulting in creative problem solutions.

The transformative learning that was anticipated by the researcher was observed relative to critical thinking but not in the area of creative problem solving as it related to the minority issue assigned. It was hoped that exposure to diverse cultures would have a greater impact on the students’ level of creative problem solving. “The research … empirically demonstrate[s] that exposure to multiple cultures in and of itself can enhance creativity” (Leung,
Maddux, Galinsky, & Chiu, Apr 2008, p. 169). As the students become familiar with students and faculty from diverse cultures, this may change in the future.

Further study is recommended to determine if these findings would be repeatable for another group of university students. Following these students through four years at the university would also be advantageous to determine the longitudinal effect of the critical thinking skills training. It is hoped that further research on the implementation of the Thinking Skills process would result in Vidal’s statement: “…the successful application of problem-solving tools in the real world usually depends on a high degree of creativity and the ability to innovate” (2009, p. 410).

These results provide an in-depth understanding of this particular phenomenon with this unique group of students. Further study is recommended. However, these preliminary results suggest that university instructors should consider exploring opportunities to integrate the teaching of critical thinking skills into instruction.

References


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Associate Professor of Instructional Technology at the University of Northern Iowa. Besides her years of classroom and online experience in creating web supported learning environments, she is a published author, keynote speaker and international presenter. She is co-author with Rita-Marie Conrad of Engaging the Online Learner: Activities for Creative Instruction (2004). Ana has recently been elected as the AECT (Association for Educational Communications and Technology) president for 2011-2012.

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Appendices

<Table 1> Review of the CoRT 1 Lessons Achievement Objectives

<table>
<thead>
<tr>
<th>CoRT 1</th>
<th>Achievement Objective</th>
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<tbody>
<tr>
<td>Lesson 1</td>
<td>How to treat ideas.</td>
</tr>
<tr>
<td>PMI: Plus,</td>
<td>The deliberate examination of an idea for good (Plus),</td>
</tr>
<tr>
<td>Minus, Interesting</td>
<td>bad (Minus) or interesting possibilities.</td>
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<tr>
<td></td>
<td>PMI use eliminates the immediate acceptance or rejection of an idea.</td>
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<tr>
<td>Lesson 2</td>
<td>All the factors we can choose or identify that are involved in a situation help us</td>
</tr>
<tr>
<td>CAF: Consider All</td>
<td>think more effectively about that situation.</td>
</tr>
<tr>
<td>Factors</td>
<td>Otherwise, we tend to think only about the first factors that come to mind.</td>
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<tr>
<td>Lesson 3</td>
<td>This lesson summarizes the first two lessons, reminding us of the important basic</td>
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<tr>
<td>Rules</td>
<td>principles involved.</td>
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<tr>
<td>Lesson 4</td>
<td>All action has a consequence.</td>
</tr>
<tr>
<td>C&amp;S: Consequences</td>
<td>Any action has either an immediate, short, medium or long term consequence.</td>
</tr>
<tr>
<td>and Sequel</td>
<td>In some circumstances, action has all these consequences.</td>
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<tr>
<td></td>
<td>A thinker needs to be aware of these possibilities.</td>
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<tr>
<td>Lesson 5</td>
<td>This lesson teaches the value of picking out and defining objectives.</td>
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<tr>
<td>AGO: Aims, Goals</td>
<td>It explains how we should be clear about our own aims.</td>
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<tr>
<td>and Objectives</td>
<td>It suggests we should also try and understand the aims or intentions of others.</td>
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<tr>
<td>Lesson 6 Planning</td>
<td>There are basic features and processes involved in planning. Lesson 6 draws together Lessons 4 and 5.</td>
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<tr>
<td>Lesson 7 FIP: First Important Priorities</td>
<td>When thinking, we need to choose from a number of different possibilities and alternatives. Priorities need to be put into order before effective thinking can take place.</td>
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<tr>
<td>Lesson 8 APC: Alternatives, Possibilities, Choices</td>
<td>A 'generative thinker' or action thinker is always interested in generating new alternatives and finding new possibilities. Most people are confined to the obvious ones.</td>
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<tr>
<td>Lesson 9 Decisions</td>
<td>Because <em>de Bono Thinking</em> is about making decisions, this lesson draws together most of the principles already learned.</td>
</tr>
<tr>
<td>Lesson 10 OPV: Other Points of View</td>
<td>Often, we are trapped into believing our viewpoint is right. A useful thinking skill is to move away from one's own viewpoint and consider the points of view of others. This lesson encourages us to ask the question, &quot;Why does that person have that point of view?&quot; This lesson does not encourage us to say, &quot;You are wrong/stupid/a dingbat! I am right!&quot;</td>
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</tbody>
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