

CLASSROOM DEBATES: A TOOL TO ENHANCE CRITICAL THINKING IN
SCIENCE

by

Martin A. Tawil

A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2016

©COPYRIGHT

by

Martin A. Tawil

2016

All Rights Reserved

TABLE OF CONTENTS

1. INTRODUCTION AND BACKGROUND	1
2. CONCEPTUAL FRAMEWORK	3
3. METHODOLOGY	8
4. DATA AND ANALYSIS	16
5. INTERPERTATION AND CONCLUSION	25
6. VALUE	26
REFERENCES CITED.....	28
APPENDICES	31
APPENDIX A Critical Thinking Lesson.....	32
APPENDIX B Student Perception Survey	35
APPENDIX C Student Interview Questions.....	37
APPENDIX D Debate Rubric.....	39
APPENDIX E Observation Form of Debate	41

LIST OF TABLES

1. Triangulation Matrix	15
2. Statistical Results	18
3. The Greatest Benefit of Taking This Course	21
4. Student Perception Survey Results	24

LIST OF FIGURES

1. Critical Thinking Process.....	4
2. Science: Bio Is Too Hard.....	11
3. Team Reflection Chart.....	14
4. CCTDI Overall Mean Results.....	18
5. CCTDI Pre-Post Test Result.....	19
6. CCTDI Domains t-test Graph (n=16)	20

ABSTRACT

The purpose of this study is to examine the effects of debating on the perception of students' critical thinking disposition. The participants were members in one of my Cornerstone Classes at Florida SouthWestern State College that was randomly selected. The data collected during this study were student surveys, student interviews, researcher observations, and pre and post of the California Critical Thinking Disposition Inventory. The researcher provided explicit instruction, conducted a pre-post California Critical Thinking Disposition Inventory, and facilitated two debates. The data collected included pre and post California Critical Thinking Disposition Inventory (CCTDI) test, observations, course evaluation, survey, and interviews. The overall results of the study showed that students benefited from the exercise of debating particularly when debating opposing points of view. Students' disposition to be critical thinkers improved as a result of debating. Debating, regardless of the topic, help enhance students' overall open-mindedness, inquisitiveness, analyticity, systematicity, and confidence of reasoning.

INTRODUCTION AND BACKGROUND

I am currently teaching the Cornerstone Experience Course at Florida SouthWestern State College (FSW). FSW is a state college conferring several bachelor's degrees, but still considered a community college due to its open admissions policy. Students at Florida SouthWestern State College are very diverse as to their socio-economic status and backgrounds. Florida SouthWestern State College demographics for the fall of 2012 included an enrollment of 16,052 (full-time 33%; part-time - 67%) students. Sixty four percent were traditional aged students under the age of 24 and thirty five percent were older than 24 years old. The gender of students is a 60/40 ratio men to women. FSW is a very diverse institution with a population that comprises of a 58.0% White, 22.9% Hispanic/Latino, 10.9% African American, and 3.5% other minorities.

The Cornerstone Experience course is required for all First Time in College (FTIC) students, and students who transfer with less than 30 credits. I am currently teaching five sections, which is my average load capacity. The students typically score low in mathematics, reading, and/ or writing. The Cornerstone Experience course main purpose is to increase the retention rates of students and to provide them with success strategies to complete their educational goal. The main topics being taught in this class are directly related to improving their team work, journal writing, critical thinking, and editing skills.

Typically, instructors conduct the lessons by providing a presentation and possibly some group work to teach critical thinking. Critical thinking is a learning

objective of this course and students' growth will be measured. The critical thinking outcome for this course is:

Critical Thinking (CT): To demonstrate skills necessary for analysis, synthesis, and evaluation

Since critical thinking is an outcome of this course, the purpose of this action research is to see the contributions, if any, will using debates enhance students' learning experience and to measure the overall critical thinking experience in the course.

This project is seeking to answer the following research question:

1. What is the effect of debating on students' critical thinking disposition?
2. What is the impact of utilizing specific instruction on critical thinking disposition?
3. Was there an improvement in the students' perceptions of their critical thinking perceptions?

As students struggle to meet the challenges of critical thinking, debating may add the increased level of positive perception and increase self-efficacy. Critical thinking disposition measures the person's ability to critically think. This project will introduce students to debating where students will participate in two debates on the same topic. However, students will be asked to switch positions for the second debate. Critical thinking is an important skill for the science classroom and the science field as it is the basis for problem solving.

CONCEPTUAL FRAMEWORK

According to Quitadamo et al (2011) critical thinking is an important skill that every college bound student will need to develop. Instructors need to find ways to enhance students' critical thinking skills especially in the science classroom (Quitadamo et al, 2011). This conceptual framework will define critical thinking and review previous studies that examined critical thinking on students' level of critical thinking in the science classroom as well as other subject areas. This framework includes that utilization of Blooms taxonomy to link between debates, increased metacognitive skills, and higher-order function as a result of debating (Magno, 2010). Lastly, the California Critical Thinking Disposition Inventory (CCTDI) is included part of this framework and to be used as a tool to measure increased growth of critical thinking disposition.

There are several definitions of critical thinking that were found during this literature review. According to Moon (2008, p.7) "Critical thinking is a capacity to work with complex ideas whereby a person can make effective provision of evidence to justify a reasonable judgment. The evidence, and therefore the judgment, will pay appropriate attention to context". In addition, many of data pointed toward the use of analysis and interpretation of information to make a decision. Patterson (2011) defined critical thinking as the use of information logically and in a sequential manner.

Patterson (2011) developed a flowchart 1 (Figure 1) to help guide the process of critical thinking by applying it to a contention or a problem. When we face contention the decision is made whether to reason or to object. Based on this decision, the process

proceeds to what he calls an expert opinion. The thinking process includes a certain level of reasoning based on the information gathered during the process.

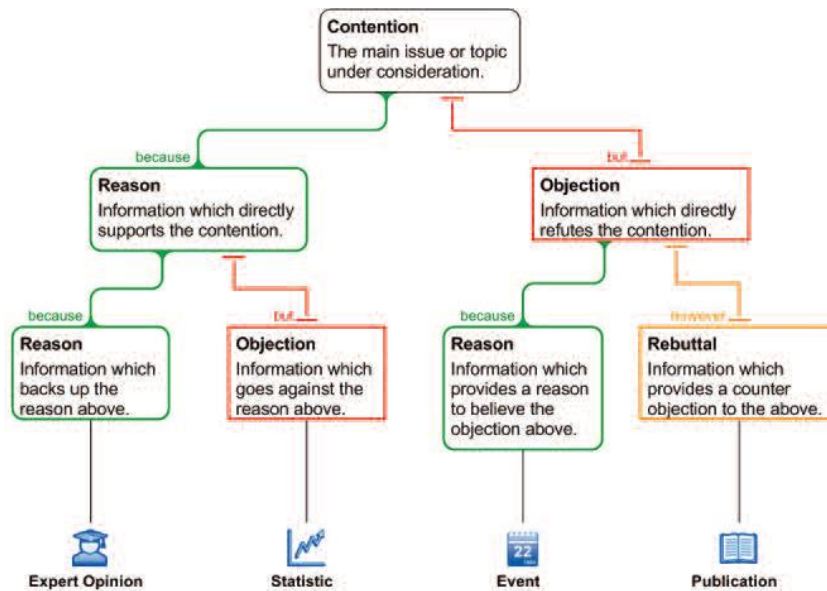


Figure 1 : Critical Thinking Process. Note. (Patterson, 2011, p. 37).

Critical thinking according to Patterson (2011) includes six stages. Each stage is unique and requires the students to process the information differently. The first stage begins with research to help begin building the argument. The second stage is structure; during this stage the logical of statement is examined. During the third stage, the assumptions are dissected. The assumption stage is a very important stage and it requires analysis to identify all assumptions found. The fourth stage is called the evidence stage where backup information is gathered to support the idea or claim. After the information is gathered, the process enters into the evaluation stage. This is the examination stage and

requires the careful look at all evidence that will leading the critical thinking process to the judgment stage. During the next stage students will use their evaluation skill to make a decision. The last stage in the process is communication where the judgment is communicated to the appropriate person. This process is invaluable to the increase in the critical thinking skills. The critical thinking process is a cognitive process which requires a certain level of flexibility during this process.

One aspect of critical thinking that often goes unstated but is a most important element for cognitive development is the ability to apply skills in a flexible and relevant manner to a situation that is entirely new. This does not mean merely being openminded and willing to change our views given good reasoning an evidence; it is about being able to take what, and how, we have learned elsewhere and apply it in a new situation.

(Patterson, 2011,p.40)

Mason (2007) examined different theorists' views of critical thinking. The findings suggest, based on the work of Robert Ennis and Richard Paul, that critical thinking is based primarily in particular skills, such as observing, inferring, generalizing, reasoning, and evaluating.

The skills of critical reasoning (such as the ability to assess reasons properly); A disposition, in the sense of: A critical attitude (skepticism, the tendency to ask probing questions) and the commitment to give expression to this attitude, or A moral orientation which motivates critical thinking; Substantial knowledge of particular content, whether of: Concepts in critical thinking (such as necessary and sufficient conditions), or of A particular discipline, in which one is then capable of critical thought. (Mason, 2007, p.343)

Regardless of which theory contributed to the definition of critical thinking, it is difficult to discount the contributions of the following skills: a) observation/ research, b) assumptions/ inferring, c) reasoning/ analysis, and d) generalization/ judgment. The steps listed are the basic skills needed to critically think and the ability to reason a judgment that will enhance open-mindedness.

Critical thinking is a vital skill that should be developed where students increase their practicum scores (Yuksel & Alci, 2012). Debates can be utilized as a method to teach students critical thinking skills. Turnposky (2004) found three connections between critical thinking and debating as tool for learning: peer interactions, analysis (Blooms Taxonomy), and increase metacognitive skills. Higher-order functions are developed as a result of peer interactions. Meaningful learning will take place when students utilize Blooms Taxonomy during debates. Debating is an activity that helps increase the level of metacognition. Setting students up in cooperative activities prior to debates increases the peer interaction. Debates should not be strictly regulated to achieve the same results. Copeland (2006) supported the work of Turnposky (2006) by stating that teaching students analytical skills increase their level of post-test achievement scores, therefore an increased learning was supported.

Oros (2007) argued that students in courses utilizing debates rated their classroom experience higher than classes not utilizing debates. Thus far, findings in the following areas are based on instructor experience and judgment. The findings in these areas strongly suggest that use of debates is a very effective method to promote and increase student participation, to help develop student writing, and to build efficacy in

understanding of political concepts and practice. According to Scott (2008) students found debating to be an enjoyable experience. Students also found debates to be challenging. Debates as a teaching strategy allows for active learning (Keller et al, 2001). Lastly, Stedman and Adams (2012) studied faculty perceptions of critical thinking; faculty determined that critical thinking engages students' higher order thinking. Also, critical thinking can be used to achieve better learning outcomes. However, Emir (2013) discovered that students should be given the freedom to exercise their thinking process without too many restrictions. The research suggested that students are able to critically think but need the guided practice provided by teachers (Emir, 2013).

Debating should be a useful tool that may promote critical thinking skills. Students' disposition toward critical thinking is an indicator of their future success (Yuksel & Alci, 2012). It is imperative that we explore the structure critical thinking debates in the classroom and assess the students' critical thinking disposition scores.

Copeland (2006) utilized a pre-test / post-test analysis of artifacts to assess critical thinking. Several of the studies examined during this literature review utilized a mixed method approach to assess the effectiveness of critical thinking (Clifton, 2012; Stedman & Adams, 2012). Several studies utilized a quantitative approach to make their determination (Scott, 2008; Ernst & Monroe, 2006; Copeland, 2006). The California Critical Thinking Disposition Inventory (CCTDI) was used to measure students' critical thinking growth in the following areas: a) Truth seeking, b) open-mindedness, c) analyticity, d) systematicity, e) self-confidence, f) inquisitiveness, and g) maturity (Emir, 2013; Yuksel & Alci, 2012). The CCTDI is an online assessment tool that asks students a

list of seventy five questions within the domains listed above. Student's ability to answer the questions will help the test to analyze their level of disposition to be critical thinkers.

In summary of this conceptual framework, students need to develop the skills needed to be avid critical thinkers. Students and faculty found critical thinking to be beneficial and an enjoyable experience. Blooms Taxonomy was utilized by studies that examined the metacognitive aspects of critical thinking. The process of critical thinking requires the collection, analysis, and evaluation of information presented. Lastly, the CCTDI tool was used to measure students' critical thinking growth in the following areas: a) Truth seeking, b) open-mindedness, c) analyticity, d) systematicity, e) self-confidence, f) inquisitiveness, and g) maturity. Overall, students need to develop these skills in order to increase their learning process especially in the science classroom.

METHODOLOGY

This action research will utilize a mixed method approach for data collection. The action study will be conducted during the first two months of the spring semester. During the research, I will administer the California Critical Thinking Disposition Inventory (CCTDI) pre and post tests. In additions students will be taught critical thinking and debating skills. Then students will select two debate topics to debate. Finally, the researcher will conduct interviews with students to help assess their perceptions of the process.

Critical thinking is an important skill that college and high school students need to develop. Critical thinking requires the use of the collection, analysis, evaluation, making

a decision based on data. Students are continually scoring below 50 on the California Critical Thinking Disposition Inventory Assessment.

Participants

The participants will be members in one of my Cornerstone Classes at Florida SouthWestern State College. The class included 23 registered members. The students' ages ranged between 18-23 years old. The group consisted of 65 percent male and 35 percent female students. In addition, 68 percent were fulltime and 32 percent were part-time students. This class was limited in diversity where 56 percent White, 35 percent Hispanic, and 9 percent Black or African American. The majority of students held a job with 53 percent working part-time, and 32 percent working fulltime.

Phase I. Participants will be given the Pre-test of California Critical Thinking Disposition Inventory (CCTDI) within the first two week of the semester. The assessment will be conducted during class to ensure that all students follow the directions and complete the assessment properly. This pretest will enable me to record the benchmark point for all students.

Phase II. Students will be instructed utilizing direct instruction and small groups on the components of critical thinking that will include collecting data, analysis, synthesis, and evaluation. The researcher will adopt the Elder Paul Model of Critical Thinking. According to Paul (n.d.) students will be taught to not just think, but emphasize thinking that entails self-improvement. The lesson components will include:

Think-Pair-Share Activity – Students will be placed into small groups to answer the following questions, a) what is critical thinking, b) what is an example of critical thinking?, c) give an example of a recent event where you applied critical thinking?

A quote by Martin Luther King, Jr. (n.d) will be read to the class to help add context to importance of critical thinking “The function of education is to teach one to think intensively and to think critically. Intelligence plus character—that is the goal of true education.”

Critical thinking defined.

Critical thinking is a disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness (Elder Paul, 2007). The lecture will include a detailed explanation of the fallacies of critical thinking outlined in Appendix A.

A Critical Thinker is able to:

- Ask vital questions and problems, formulating them clearly and precisely
- Collect and assesses vital information, using abstract ideas to interpret it effectively
- Develop well-reasoned and tested conclusions
- Be openminded about alternative points of view
- Can recognize and assess assumptions, implications, and appropriate consequences

- Able to communicate effectively with others
- Able to avoid fallacies of critical thinking – thinking deeply by analyzing the situation.

Phase III. Students will be placed in small groups of 4 to five students to read and analyze “Science: Bio is too hard” (see Figure 2) case study utilizing the Elder Paul Elements of Thought.

This is my second semester in college and I began to take my science sequence. I am a pre-nursing student and I need to take a lot of science courses. The GPA is very important and I am not doing well in Bio. This is my first bio class and I need a good grade. In high school I did great in bio and I did not have to study like this! I study so much for the classes but I cannot wrap my head around this class.

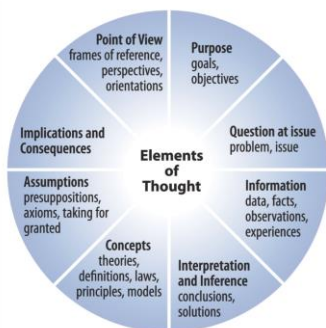
My college professor has been very understanding and helpful but my grades are very good. Below is what I received on my last quizzes, homework, and tests:

Homework	70%
Quiz	58%
Chapter 1 test	60%
Chapter 2 test	42%

This is the middle of the semester and I am not sure what to do. I think I might fail this course and I need it to get into the nursing program.

Case analysis:

Using the Elements of Thought below (Elder Paul, n.d.) student will collaboratively answer apply the scenario to wheel starting with purpose.



Elder Paul (n.d.)

Figure 2. Science: BIO is too hard.

Phase IV. Students will be instructed on debating using direct instruction and class discussions. Students will be placed into groups of four to five students for a think-pair-share activity to answer the following questions:

- 1- What is debating?
- 2- What rules would you come up with to maintain order?
- 3- What type of evidence is acceptable?

Each group will report their discussion to the class. I will guide the process during the lesson. Followed by providing students with debating rules below:

Debating arguments rules:

- Must be logical
- Answer the question precisely
- Stated in a calm voice
- Must not show emotion
- Pick the important point
- Targets the statements not individuals
- Delivered by the Speaker

Statements made during the debates must be evidence based and researched. Evidence must be stated to help support the group's assertions. Groups cannot merely use examples without evidence to support them.

After the instructions about debating, students will be placed into two teams to select the topic for the debate and to elect two team captains. The team captains will be responsible for assigning the research to their respective teams. The teams will be encouraged to be

united, organized, well informed, and support the captain. This will be worked on the entire semester by facilitating small activities that will ensure all students rotate groups and work with each other prior to the debates. This step will provide structure and consistency in the debates. This 1.5 hours lesson will enable students to learn the steps needed to debate effectively.

Phase V. Debate 1 - Evolution vs. Creationism:

For this debate, students will be allowed to pick which side they will debate. The purpose is to keep students' comfortable during the first debate. Tables and chairs will be set up to help teams face each other during the debates. A three member panel of FSW professors will be convened to award the points to each of the teams as they argue an effective point during the debate. I will serve as moderator to help keep the focus of the debate, and ensure the teams adhere to the debate rules. The debate will be conducted as follows: a five minute opening statement by each team followed by a three minute rebuttal. Students will be required to adhere to the rules of the debate by raising their hands and being recognized by the moderator prior to speaking. Students will be asked to keep their responses directly related to the question being argued. I will record qualitative data as how students are engaging in the critical thinking process and will take several photos to document the debates.

Phase VI. First debate analysis and reflection

Students will place back into their teams. Student will play "armchair quarterback" to reflect upon the debates by analyzing which statements and arguments were effective and why. The teams will examine the key concepts or evidence that stood

out during the debate. This exercise is a learning experience where students will learn from their arguments and seek improvement prior to the second debate. Teams will complete a reflections chart (Figure 3). Students will report the information during the class discussion.

Things were done well during the debate?	Things needed improvements	What changes would you make for the next debate

Figure 2: Team reflection chart.

Phase VII. Debate 2 – Evolution vs. Creationism

Debate 2 will be conducted approximately four weeks after debate 1.

During the second debate, I will ask students to use the same format as we did during the first debate with one exception. Students will switch side for this debate.

Students will research and argue an opposing point of view. I will record qualitative data as how students are engaging in the critical thinking process using the rubric in appendix 5.

Phase VIII. The post-test of the CCTDI will be conducted during class and after the debates are completed.

Phase IX. I will select five to six students randomly from class to conduct a one-on-one interview to document the students' perceptions about the debate. I will ask

questions about how the students prepared for the debate and how was their overall experience during the debate.

Phase VII: Students will be given a voluntary 10 question survey to help self-assess their critical thinking skills.

Data Collection

All data collections will be administered to my Cornerstone classes. The class will be selected randomly selected from my course load. The Data collection will begin with the administration of the Critical Thinking Disposition CCTDI. I will conduct two debate sessions approximately four weeks apart and record observation utilizing appendix 5.

Followed by the intervention, students will be given the CCTDI post-test. Then, I will randomly select five to six students to interview about their experience during the debates and critical thinking.

Finally, all students will be given a voluntary survey to self-assess their critical thinking improvement.

Triangulation Matrix

Table 1
Triangulation Matrix

Focus Questions:	Data Source 1	Data Source 2	Data Source 3
Subquestion 1 What is the effect of debating on students'	Pre-Post test of the California Critical Thinking Disposition	Teacher observation 1	Student Interviews

critical thinking disposition?	Inventory (CCTDI)		
Subquestion 2 What is the impact of utilizing specific instruction on critical thinking?	The Student Evaluation of Instruction Survey	Teacher observation 2	Student Interviews
Subquestion 3 Was there an improvement in the students' perceptions of their critical thinking?	Pre-Post test of the California Critical Thinking Disposition Inventory (CCTDI)	Analysis of Teacher observation 1 & 2	Self- Assessment student Survey

DATA AND ANALYSIS

The study's questions will be examined in depth utilizing observations, students' self-assessment survey, CCTDI results, and student interviews. The results of the study will also look at the significance of the results of the overall CCTDI.

The effects of debating on students' critical thinking disposition

During the first week of instructions students completed the pre-test of the California Critical Thinking Disposition Inventory (CCTDI) followed by a post-test during the eight week of instruction. The CCTDI is a tool that was utilized to measure

students' critical thinking growth in the following areas: a) Truth seeking, b) open-mindedness, c) analyticity, d) systematicity, e) confidence in reasoning, f) inquisitiveness, and g) maturity of judgment. Each of these areas is an attribute that is tied to the Paul-Elder Model of Critical Thinking. Truth seeking measures the student's ability to seek and question facts presented. Often students tend to believe and rely on sources of information without questioning the source or the information presented.

Given a certain set of facts students should exercise a certain level of skepticism to seek the truth. Truth seeking requires a certain level of analyticity of information to help develop the needed critical thinking skills. Truth seeking also requires inquisitiveness to help guide the student towards the examination of the facts being presented.

Inquisitiveness is an internal attribute students have and develop over time to help motivate them towards questioning the order of things around them. This attribute is the foundation of thinking and initiative for students to develop and hone. However, inquisitiveness does not necessarily relate closely to maturity of judgment. The maturity of judgment requires a certain level of confidence in reasoning. Depending on the student's age many students exhibit a good level of confident in reasoning but lack maturity of judgment. Maturity of judgment requires a sound logical thinking that helps builds confidence of reasoning. Students may not be aware of their level of maturity thus make decisions that are not grounded in logic making their critical thinking skills weak at best. Lastly, logical reasoning is dependent on open-mindedness and systematicity.

Systematicity is skill which enables the person to use critical thinking very systemically. However, many people tend to think as needed but lack systematicity. This skill is

important to help develop a better precision and accuracy of thinking. Finally open-mindedness is the most important skill to be developed in the critical thinking model. Open-mindedness enables students to examine the facts from all sides and evaluate the information for correctness. Students that lack open-mindedness tend to rely on their own thinking by discounting reliable information being presented to them thus making an erroneous decision or even failure to act.

The overall results of the CCTDI (figure 1) show the improvement in students' overall average results. The results showed an increase in students' critical thinking disposition by 21 percent overall (Figure 4).

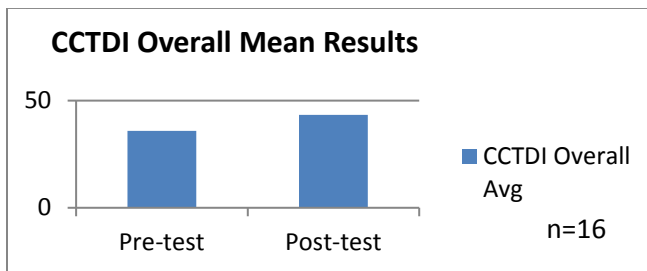


Figure 3. CCTDI overall mean results.

However, it is imperative to check the results against a paired t-test to measure their significance. The standard deviation of the pre and post-tests were 35.20 and 42.20 respectively. The standard deviation combined with the average difference between the pre and post tests which was an increase of 12.75 points, showed a strong correlation between the data sets where the results are less likely to occur at random (table 2).

Table 2
Statistical Results

Test (n=16)	Pre-test	Post-test	Overall
STDIV	35.200	42.20	-
Pre-Post Diff Mean	-	-	12.75
T-test	-	-	0.012

The t-test performed showed a significant improvement based on .05 significance test. The study's data resulted in a 0.012 t-test which shows the significance of the improvements as a result of the interventions in this study. The overall results of this study comparing the pre and post-tests were statistically significant. Figure 2 below exhibits the results of the different strands of the CCTDI. Calculating the results of a paired t-test to measure the significance of the results will ensure better validity of the outcome.

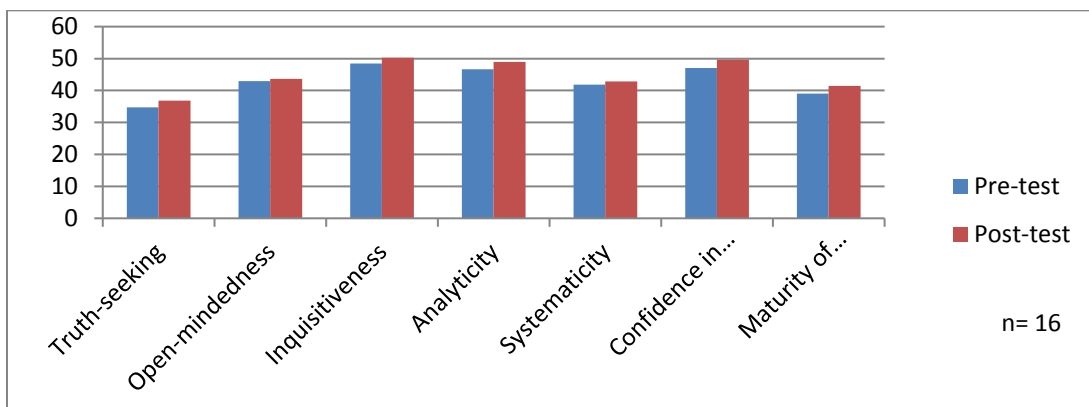


Figure 4: CCTDI pre-post test result.

Looking at the separate domains in Figure 5, there were positive net improvements in all areas. Figure 6 below will show the results of the t-test analysis of each domain.

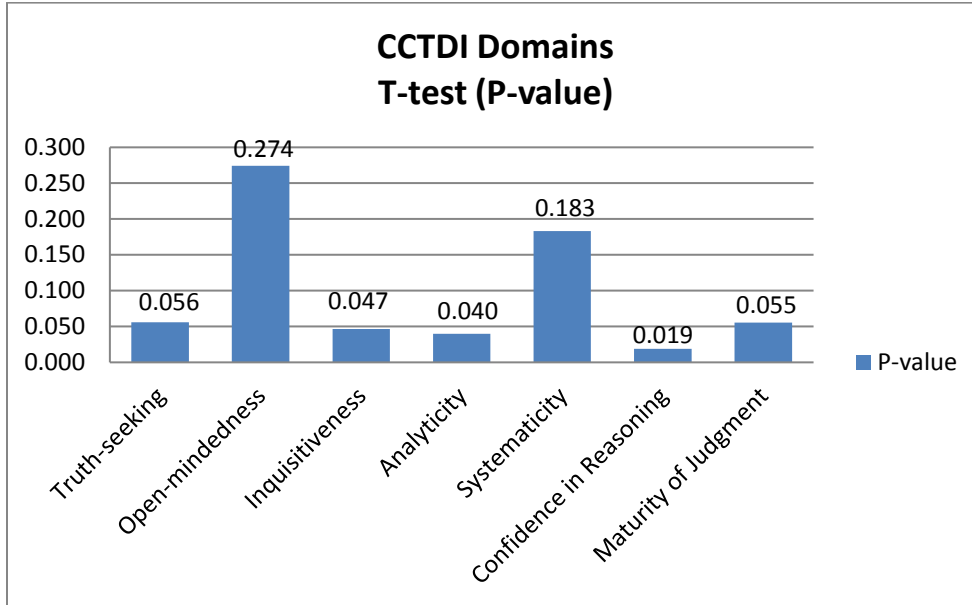


Figure 5. CCTDI Domains t-test (p-value) graph.

Based on the t-test, there were significant improvements in open-mindedness, inquisitiveness, analyticity, systematicity, and confidence of reasoning. All of these areas recorded a t-test showed a p-value of less than 0.05 which again supports the significance of the results. However, two areas were slightly above the required 0.05 significant level where the data did not show significant improvement. The areas that did not show significant improvements were maturity of judgment and truth-seeking. As explained earlier in this study, these two areas usually do not improve during an eight week period. In order to improve maturity of judgment the study would need additional longevity; this also applies to truth-seeking. The skills typically do not improve as a result of an intervention but as result of growth over time.

The impact of utilizing specific instruction on critical thinking

The research to help answer this question will rely on the Student Evaluation of Instruction (SEI) survey which assesses the instructor's overall teaching style and effectiveness. The instruction for this class was differentiated to allow the specific instruction of debating that included lessons described earlier in the methodology section. The SEI is administered at the end of the semester by the college. The students were asked this question "The greatest benefit of taking this course was." Since the purpose of this study is to examine the effects of debating as a tool to improve critical thinking skills, this question is vital to help support the results of the overall study. Students in the selected section answered by 62.5 percent that critical thinking was the greatest benefit from the instruction of the class compared to the average of 52.86 of all four other sections taught by the researcher. The other related importance is the peer interaction which was 37.5 percent compared to an average of 15.48 percent (table 2). Critical thinking was taught explicitly during this study and several interventions were implemented to help improve students' critical thinking skills.

Table 3
The Greatest Benefit of Taking This Course

	Critical thinking	Peer interaction
This class (n=10)	62.5	37.5
Average (n= 47)	52.86	15.48

Another point of the data collected was to help support this research question was a direct student survey. The researcher administered a survey at the conclusion of the study to assess students' knowledge learned during the course. One of the key questions that was asked directly about the instruction received was "As a result of critical thinking instruction, I am able to ask vital questions to help gather more information." This

question was posed to students to determine if students gained critical thinking skills.

Students responded with 54 and 46 percent strongly agree and agree respectively.

Overall, it is evident that students gained critical thinking skills as a result of the specific instruction implemented during the study. Students responded positively during two surveys to help provide evidence to support that debating and specific critical thinking instruction benefited their overall critical thinking skills.

Improvement in students' perceptions of their critical thinking skills

To help answer this research question “Was there an improvement in the students’ perceptions of their critical thinking?” The researcher will rely on the observations conducted during the debates, student interviews, and the self-perception survey. Utilizing the different data collected will help the researcher develop an understanding of the overall students’ perception of their critical thinking skills.

The researcher utilized a predetermined rubric to assess the groups’ performance during the two debates. The rubric documented the group’s ability to organize information, formulate arguments, communicate their arguments, the etiquette of delivery, and overall debating skills. These categories will enable the researcher to assess the overall debating as outlined in this study. The first debate was well structured and students debated well. Nonetheless, it was apparent that improvements are needed. Students were well organized and supported their arguments with ample researched information. During the first debate students did not provide an alternative view nor did they evaluate the opposite viewpoints well. The teams did not act a cohesive team and needed to develop this skill. Students maintained their point of view and did not exercise

good open-mindedness. The debating was active but students maintained a solid point of view regardless of the new information presented. The students appeared to enjoy the debating and communicated effectively. Students waited their turn during the debate and their debating style was effective.

As result of the first debate, students were asked to switch sides for the second debate. Since students were not open-minded, switching sides will force students to put themselves on the other side of the argument; students were asked to debate the opposite view point. There was an observable improvement. The challenge of arguing opposing point of view has created the opportunity for students to appreciate the other side of the argument. This step resulted in a more open-minded argument and a true appreciation of all sides of the debate. During the second debate, students became more engaged and communicated effectively. The results of the second debate led to both sides accepting both points of view.

The researcher also conducted student interviews and conducted a perception survey to assess students' overall perceptions. The student comments during the interviews supported this research question. Overall, students did state that debating improved their overall critical thinking skills. Students liked the debating topics for example one student stated "I liked talking about topics that no one likes to talk about." The topics and debating appear to increase their inquisitiveness. Students learned to think critically where a student stated during the interview "debating helped me listen to other side." The process helped students apply this skill to the topic. Another student stated "Debates helped me reflect and apply critical thinking in my life."

Overall, students showed a significant improvement in their debating skills as exhibited by the data collected during this action research study. Students' disposition towards critical thinking appeared to improve during this study based on the two observations completed during the debates.

Finally, the results of the student perception survey listed in table 4 below showed the students' responses to the various questions asked. The survey asked specific questions about students own perceptions of critical thinking. The results show that students' perception of critical thinking improved as a result of the debating and instruction implemented during the study.

Table 4
Student Perception Survey Results (n=13)

Survey Question (n=13)	Strongly agree	Agree	Strongly Disagree	Disagree
During the Debate I was able to formulate the problem clearly and precisely	30.77%	61.54%	0	7.69%
As a result of critical thinking instruction, I am able to ask vital questions to help gather more information	53.85%	46.15%	0	0
I am able to have well-developed reasoning skills	50%	50%	0	0
I developed a good level of open-mindedness	76.92%	23.08%	0	0
I am now able to recognize and assess assumptions better	46.15%	46.15%	0	7.69%
I am more capable of identifying most possible implications	30.77%	53.85%	0	15.38%
I am a more effective communicator now	23.08%	69.23%	0	7.69%

I am better at evaluating data to make informative decisions	38.46%	53.85%	0	7.69%
Overall, Debating helped me increase my critical thinking skills and helped me understand all sides of the argument.	84.62%	15.38%	0	0

The overall results of the survey supported this research question where the majority of students either strongly agreed or agree with the questions posed. Students felt that their critical thinking skills improved as a result of debating. Students reported positive results where the majority of students felt and self-reported that they improved their critical thinking results.

INTERPERTATION AND CONCLUSION

This study provided important insight in the process of improving critical thinking. As stated earlier in this study, critical thinking is an important skill that every college bound student will need to develop in the science classroom (Quitadamo et al, 2011). Critical thinking serves as the basis of science investigation and discovery.

Debating in the classroom showed a significant improvement in students' overall critical thinking disposition. Debating, regardless of the topic, help enhance students' overall open-mindedness, inquisitiveness, analyticity, systematicity, and confidence of reasoning. Students improved in open-mindedness which helps students examine the alternative point of view and adopt if logical. Students stated in their overall survey and interviews that they enjoyed the debating experience which supports Oros (2007) and

Scott (2008) studies. Both researchers (Oros, 2007 & Scott 2008) found that students that experience debating in their classrooms rated their classroom experience higher.

Another important discovery resulting from this action research was the students' ability to see the other side of the argument. Students during the second debate were asked to argue opposing point which is contrary to their own values. This step led to particularly important results. Students may need to be placed in simulated situations where they are asked to argue an opposing point of view. This step showed that students' open-mindedness increased where students began to accept the opposing argument as a possible alternate view. Accepting or not opposing an alternative point of view is important to the development of critical thinking. The results further supports Turnposky's study (2004) where the researcher found that debating provided a connection between debating and critical thinking. One particular area was also supported in this action research was the positive peer interaction realized by the participants as also found by Turnposky (2004).

VALUE

This action research study contributed to my overall professional growth. As part of my current teaching assignment, I am responsible to teach students critical thinking. Students rely continuously in information that is passed on from friend, the internet, or any other source. This is frustrating to see how many of my incoming students lack in their potential to be critical thinkers. The study provided valid and reliable data to support a new method of teaching critical thinking in any classroom.

The utilization of debates in the classroom was fun for the students and the researcher. However, the significance of the results showed that debating is more than just an experience. Debating supported and enhanced students' overall critical thinking disposition. Students' also improved their overall perception of critical thinking. Most significantly, debating as an instructional tool helped students gain the skills needed to be better critical thinkers.

Beginning in the fall, debating will be included in all sections that will be taught. The researcher will continue to examine teaching pedagogical methods that may lead to better critical thinking skills.

REFERENCES CITED

- Clifton, G. (2012). Supporting The Development of Critical Thinking. *Widening Participation Lifelong Learning* , 29-39.
- Copeland, J. (2012). Collaborative Action Research on Critical Thinking in The Libraray . *Medium*, 10-11.
- Emir, S. (2013). Contributions of Teachers' Thinking Styles to Critical Thinking Dispositions . *Educational Sciences: Theory & Practice* , 337-347.
- Ernst, J., & Monroe, M. (2006). The Effective of Environment-Based Education on Students' Critical Thinking Skills and Disposition Towrds Crititcal Thinking. *Environmental Education Research*, 429-443.
- Keller, T. E., Whittaker, J. K., & Burke, T. K. (2001). Student Debates in Policy Courses: Promoting Policy Practice Skills and Knowledge Through Active Learning. *Journal of Social Work Education*, 343-355.
- Magno, C. (2010). The Role of Metacognitive Skills in Developing Critical Thinking. *Metacognition & Learning* , 137-156.
- Mason, M. (2007). Critical Thinking and Learning. *Educational Philosophy & Theory*, 339-349.
- Moon, J. (2008). *Critical Thinking: An Exploration of Theory and Practice*. London: Routledge.
- Oros, A. (2007). Let's Debate: Active Learning Encourages Student Participation and Critical Thinking. *Journal Of Political Science Education*, 293-311.
- Patterson, F. (2011). Visualising the Critical Thinking Process. *Issues*, 36-41.
- Quitadamo, I. J., Kurtz, M. J., Griffith, L., Cornell, C., Hancock, J., & Egbert, B. (2011). Critical-Thinking Grudge Match: Biology vs. Chemistry-Examining Factors That Affect Thinking Skill in Nonmajors Science. *Journal Of College Science Teaching*, 19-25.
- Scott, S. (2008). Perceptions of Students' Learning Critical Thinking Through Debate in a Technology Classroom: A Case Study. *Journal Of Technology Studies*, 39-45.
- Stedman, N. L., & Adams, B. L. (2012). Identifying Faculty's Knowledge of Critical Thinking Concepts and Perceptions of Critical Thinking Thinking Instruction in Higher Education. *North American Colleges and Teachers of Agriculture Journal*, 5-12.

Turnposky, N. (2001). The debate debate. *The Clearing House*, 52-69.

Yüksel, G., & Alci, B. (2012). Self-Efficacy and Critical Thinking Dispositions as Predictors of Success in School Practicum. *International Online Journal Of Educational Sciences*, 81-90.

APPENDICES

APPENDIX A
CRITICAL THINKING LESSON

Think-Pair-Share Activity – Students will be placed into small groups to answer the following questions, a) what is critical thinking, b) what is an example of critical thinking?, c) give an example of a recent event where you applied critical thinking?

A quote by Martin Luther King, Jr. (n.d) will be read to the class to help add context to importance of critical thinking “The function of education is to teach one to think intensively and to think critically. Intelligence plus character—that is the goal of true education.”

Critical thinking defined.

Critical thinking is a disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness (Elder Paul, 2007).

Fallacies in Reasoning will be explained as way to avoid during the process of debating:

- 1- Appeal to a questionable authority. Example: using actors or sports figures to endorse products.
- 2- Jumping to conclusions and making generalizations. Fast and quick generalizations with support or evidence. Example: One college student does not pay back a loan. The bank manager concludes that students are poor risks for loans or assume all members of the group are the same.
- 3- Attacking the person. Attacking the person rather than discussing the issue. Example: during a personal argument, we call a person fat, ugly or something else. This derails the argument.

- 4- Appeal to Common Belief. Just because it is common belief does not make it true

Example: At one time people believed that the world was flat

- 5- Common Practice. If everyone does it, it must be alright.

Example: It's OK to cheat on your taxes. Everyone else does.

- 6- Appeal to Tradition. We've always done it that way

Example: We can only eat turkey for Thanksgiving or ham for Christmas.

- 7- Slippery slope. Dire consequences

Example: if you fail this class, you are a failure in life.

- 8- Wishful thinking. Too good to be true schemes.

Example: pyramid schemes

- 9- Appeal to fear or scare tactics. Emotions interfere with rational thinking.

Example: political attacks and advertisements that describe dire consequences.

I will explain the process of critical thinking. The process also included looking at possible alternative views.

APPENDIX B
STUDENT PERCEPTION SURVEY

As a result of critical thinking instruction and debating, please answer the following questions using self-assessment using:

Strongly agree Agree Strongly disagree Disagree

- 1- I am able to formulate the problem clearly and precisely.
- 2- I am able to ask vital questions to help gather more information.
- 3- I am able to have well-developed reasoning
- 4- I am able to maintain a good level of openmindedness
- 5- I am able to recognize and assess assumptions
- 6- I am able to identify most possible implications
- 7- I am able to communicate more effectively
- 8- I am able to evaluate data to make informative decisions
- 9- Overall, debating helped me increase my critical thinking skills

APPENDIX C
STUDENT INTERVIEWS QUESTIONS

Students will be asked the following open-ended questions about critical thinking:

- 1- What did you like most about debating?
- 2- Did debating help you formulate the problem clearly?
- 3- What did you learn about critical thinking? And why?
- 4- What was the debating like for you? And why?
- 5- Did debating help improve your overall critical thinking? Why or why not?
- 6- Did debating help improve your communication skills? Why or why not?

APPENDIX D
DEBATE RUBRIC

Aspect	Exemplary	Satisfactory	Unsatisfactory
Organization	Well-structured arguments that are factual and evidenced based.	Good structured argument s which was factual and evidenced based.	Arguments were not evidenced based and structured
Arguments	All Arguments were based on Elder Paul (n.d.) Elements of Thoughts	Most of the arguments were based on Elder Paul (n.d.) Elements of Thoughts	A few of arguments were based on Elder Paul (n.d.) Elements of Thoughts
Communication	All Arguments were delivered in a clear and concise statements	Most of the arguments were delivered in a clear and concise statements	Some of arguments were delivered in a clear and concise statements
Delivery	Smooth, effective, and articulate statements were made during the debate with good voice control and non-emotional.	Somewhat Smooth, effective, and articulate statements were made during the debate with good voice control and non-emotional.	Poor and ineffective, statements were made during the debate with good voice control but emotional.
Debating skills	Good speed and responsiveness during the debate. Arguments and statements were made in an effective and persuasive manor	Good speed and responsiveness during the debate. Arguments and statements were somewhat made in an effective but non-persuasive manor	Good speed and responsiveness during the debate were slow and ineffective.

Comments: _____

APPENDIX E
OBSERVATION FORM OF DEBATE

Debate # _____

Criterion	Excellent	Very Good	Fair	Poor
Issues identified completely				
Position clearly stated				
Stake holders clearly identified				
Evidence/reasons/ ethical principals opposed to opponents position provided				
Alternative courses of action provided				
Alternative points of view evaluated				
Argument organized logically and evidenced based				
Students spoke loudly enough to be heard				
Reasoning was evidenced based				
Speed and delivery was on target				
Students actively engaged during the debate				
Groups appeared organized during the debates.				