Critical Thinking in Higher Education: A Strategy for Deployment

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Abstract – The development of critical thinking skills at the undergraduate level challenges many educators. Helping students learn to think within their discipline is greatly facilitated when they possess basic and discipline-specific critical thinking skills. This paper presents a campus-wide research project being conducted at The Citadel to assess critical thinking skills among students, to develop interventions for critical thinking, and to monitor the impact of these interventions. The school took three years to establish a baseline of critical thinking skills for their first semester freshmen and second semester juniors using the well-recognized Cornell Critical Thinking Test. A framework for critical thinking developed through a collaboration of faculty members provides the schema to identify and categorize the interventions and assessment methods. The background material, baseline results, framework, and proposed interventions will be discussed.

Keywords: Critical thinking, Cornell Critical Thinking Test, interventions

BACKGROUND

For the three years, The Citadel has engaged in a campus-wide endeavor to baseline student performance in terms of critical thinking. Populations of first semester freshmen and second semester juniors were selected and administered the Cornell Critical Thinking Test – Level Z (CCTT). This effort to establish a performance baseline has proved valuable in understanding student critical think abilities, the processes necessary to measure critical thinking, and the complications that must be overcome to obtain authoritative results.

The CCTT was selected from other critical thinking tests by The Citadel Academy for The Scholarship of Teaching, Learning, and Evaluation (CASTLE) as the standardized instrument for assessing critical thinking among Citadel students. CASTLE represents a cross-section of faculty within the disciplines and departments at The Citadel. With over 40 members, CASTLE brings together a diversity of academic viewpoints and experiential perspectives. The result is a dynamic group of scholars and professionals willing and able to undertake the challenge of developing a common definition of critical thinking.

As a quasi-experimental design research effort, this research effort took into account conflicts with academic and college requirements, which complicated the administration of the CCTT. The experimental design called for assessing critical thinking across the broadest possible timeframe of academic and cognitive development. As a result, the freshmen were tested in their first or Fall semester, whereas the juniors were tested in their sixth or Spring semester. Efforts were made to randomize the selection of students to the greatest extent possible. The freshmen were selected from class sections of Citadel 101 Orientation (CIT 101) or CIVL 100 Introduction to Civil Engineering courses. The juniors were selected randomly from the student population. The CCTT was administered to freshmen by their CIT 101 and CIVL 100 professors, whereas the juniors were assembled in large testing rooms and the CCTT was administered by faculty and graduate assistants. Due to the mandatory training schedule for freshmen at The Citadel, it was not feasible to completely randomize the population. While engineering freshmen constituted a sizable portion of the population, the 20 to 35 percent transfer rate to other majors was considered to reduce the impact on the results.

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The CASTLE group also adopted Ennis' definition of critical thinking as the common definition to be applied for this and related research. According to Ennis [Ennis, 1], critical thinking "is reasonable reflective thinking that is focused on deciding what to believe or do". This definition is considered appropriate and useful because the CCTT was developed by Ennis, Millman, and Tomko [Ennis, 2].

The CCTT Level Z is a 52-item, multiple choice, general critical thinking test, that is administered in a 50-minute period. Each item has three choices with one keyed answer. While not an aspect of the current research, the CCTT subcategorizes critical thinking into three types of inferences (induction, deduction, and evaluation) to beliefs and four types of bases (results of other inferences, observations, statements made by others, and assumptions) for the inferences. Once established, these subcategories may provide insight into course and curriculum development.

As recommended by Ennis, [Ennis, 3] "One use for which the Cornell critical thinking tests are suited is the detection of differences in critical thinking ability between groups."

DEVELOPMENT OF A COMMON FRAMEWORK

Adopting the Ennis definition and the CCTT supported the development of a common framework for illustrating and communicating the elements of critical thinking. Through a series of faculty meetings devoted to identifying the essential elements and characteristics of critical thinking, a grouping of these elements emerged and came to be illustrated as a Venn diagram [Plemmons, 4]. When the results were presented graphically as a Venn diagram, the interrelationships between the elements became evident and illustrated a common understanding of the processes important in developing critical thinking among our students. The Venn diagram, Figure 1, provided the CASTLE group with a common framework for discussion and application.

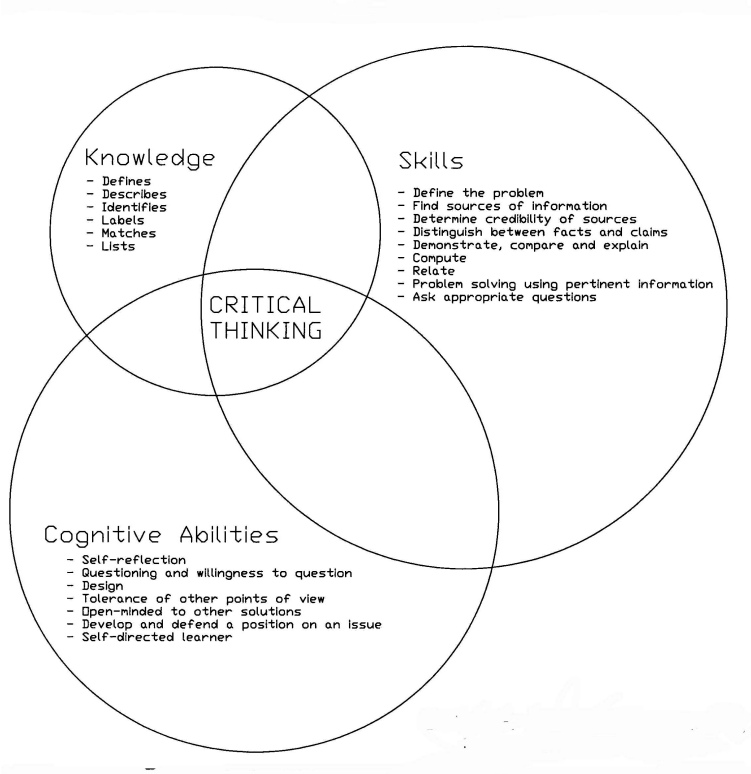

Figure 1. Critical Thinking Framework

As shown in Figure 1, three areas of Critical Thinking consist of Knowledge, Skills, and Cognitive Abilities. Knowledge consists of the basic information, facts and concepts that are essential to understanding a particular discipline. Skills represent procedural knowledge or the ability to do something with the knowledge rather than merely respond factually. Cognitive abilities refer to the examination and reflection upon a problem or issue using

self-directed questioning. Critical thinking occurs when the student is able to effectively assimilate all three areas to solve a challenging problem.

Recognizing that the three areas of knowledge, skills and cognitive abilities were not equally involved with nor reflective of critical thinking abilities, the group chose to show this importance of each area by changing the relative size of the circles. Knowledge takes a smaller, yet foundational role in critical thinking, while skills and cognitive abilities play critical roles in the overall process. In carrying this conversation and line of thought further, the project team realized that the size of the three circles should represent the relative amount of class work spent in these areas. This idea deemphasizes the student's time spent on acquiring subject knowledge alone and emphasizing the development of skills and cognitive abilities while using that knowledge, and thereby learning it and is able to apply it within their discipline.

Project team interaction and validation proved important to acceptance of the critical thinking framework. Group acceptance for the application and potential of the critical thinking framework came when the relative importance (size) of the three areas was posited and elaborated upon. This lead several professors within the project team to consider ways to emphasize skills and cognitive abilities in their classrooms while maintaining or expanding the amount of subject knowledge being presented. As an external validation of the model, the three areas of knowledge, skills, and cognitive abilities are similar to those presented by others describing problem solving strategies. Kurfiss [Kurfiss, 5] and Huba [Huba, 6] utilize similar groupings in their presentations concerning critical thinking.

BASELINE RESULTS

Establishing a baseline for student performance is important for assessing current abilities and for determining possible interventions to improve basic knowledge, skills, and attitudes toward critical thinking. The need to assess critical thinking among undergraduate students arises from the emphasis institutions place on curriculum requirements and the skills associated with the specified or implied requirements. These skills include, where appropriate, written communications, critical thinking, logical reasoning, and resource and reference usage. For example, the Citadel catalogue states "…Each course, or sequence of courses, which addresses a core curriculum requirement incorporates, where appropriate, all the following skills:…critical thinking…" From this commitment to students comes the need to assess students' critical thinking skills. This was recognized by the research group as a need to be addressed.

Addressing the development of critical thinking skills between a student's first and sixth semesters prompted the involvement of several cross-disciplinary professors and staff. Classes and students were selected, tests were organized, the tests were administered, graded, and the results analyzed. The results of three years of testing are presented below:

Year/Class (2004-2005)	**Number (N)**	**Average Correct Score out of 52**	**Comparative Percentile**
Freshmen (4A)	112	24.7	25
Juniors (2B)	48	25.0	25
Year/Class (2005-2006)	**Number (N)**	**Average Correct Score out of 52**	**Comparative Percentile**
Freshmen (4A)	72	25.3	25
Juniors (2B)	46	28.2	55
Year/Class (2006-2007)	**Number (N)**	**Average Correct Score out of 52**	**Comparative Percentile**
Freshmen (4A)	91	23.0	12
Juniors (2B)	61	26.7	45
Comparison Group	**Number (N)**	**Average Correct Score out of 52**	**Percentile**
Undergraduates	100	27	50

Table 1. Comparative Results of Cornell Critical Thinking Testing

The group selected for comparison came from a population of 100 undergraduates in a small state university in upstate New York, with mean of 28.5. Due to the nature of the data, approximate conclusions can be made concerning the results of the CCTT. These findings include:

- Results suggest that junior students have higher critical thinking skills.
- Testing conditions may impact the results of this test. Freshmen took their CCTT in their CIT 101 or CIVL 100 classroom under the administration of their professor or a graduate student. For the juniors, they initially took their CCTT on Saturday morning in a large auditorium under less than optimum conditions. Realizing the need for better testing conditions, juniors for the past two years have been assembled in well lit and comfortable classrooms on a Tuesday or Thursday morning, and given an explanation of the importance of the CCTT to the school. After finishing the CCTT, a lunch was provided.
- Given the limitations of the study and the variable testing conditions, data suggest that the challenging and dynamic environment of The Citadel promotes critical thinking.
- Analysis of the subcategories indicate that both freshmen and junior students were most successful at deduction and induction questions, while both freshmen and juniors students struggled with questions of meanings, assumptions, and specific deduction questions.
- More data are needed in order to draw relative, more concrete conclusions.

PROPOSED INTERVENTIONS

To improve our student's critical thinking skills the following interventions are proposed:

- Formal critical thinking skills instruction should be embedded within the core curriculum.
- During freshmen year develop and implement critical thinking modules complete with content, reading prompts and reflective writing assignments. Test materials should be made available to freshmen orientation courses.
- Use the Critical Thinking Framework to develop specific modules and applicable assessment instruments.
- For selected classes, orient the course instruction using the critical thinking framework to develop and assess knowledge, skills, and cognitive abilities.
- Implement continuous knowledge enrichment and course content dissemination activities across disciplines on campus.
- Make recurring presentations at CASTLE meetings on critical thinking efforts and make resources available for teaching and developing critical thinking skills.

CONCLUSIONS

The critical thinking research at The Citadel has only begun but the preliminary results look positive. Now the effort turns to a more thorough analysis of the data and of the academic and institutional activities that promote critical thinking. The baseline described above provides a basis for looking at the educational process and formally documenting the results. In addition to the proposed interventions, efforts will be made to moderate the impact of the different testing conditions.

Efforts have been successful in classifying student performance related to critical thinking skills development and in correlating results between student performance in their first and sixth semester. Now is the time to further explore the learning processes to understand and document the cause and effect of critical thinking skills development at The Citadel.

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