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Helping Honors Students Improve Critical Thinking

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Interest in critical thinking (CT) has increased dramatically in the past 25 years. This represents a growing awareness that high school and college graduates often do not have the necessary CT skills to meet the challenges of a changing world. Research shows that college students who take critical thinking courses report their ability to think critically has greatly improved (Block, 1985; Rubinstein, 1980; Rubinstein & Firstenberg, 1987). The preponderance of evidence from assessment studies using control groups indicates that "gains are most pronounced when instruction is specifically designed for the promotion of critical thinking. Critical thinking does not automatically result as a byproduct of standard instruction in a content area" (Halpern, 1996, p. 10).

BACKGROUND

Many colleges and universities in the United States now offer critical thinking courses as part of their general education program (Halpern, 2000). Despite this increased emphasis on critical thinking in higher education, there is a paucity of literature on critical thinking within honors programs. Thus there is a pressing need for adequate evaluation of CT outcomes within honors education.

Development of CT abilities remains central to the concept of critical thinking. CT skills or abilities are defined as the power to do something under circumstances in which there are no constraints to thinking critically and the individual possesses the appropriate background knowledge to apply these abilities (Norris, 1994). CT abilities include interpretation, analysis, evaluation, inference, explanation and self-regulation (The Delphi Report, 1990).

Many experts believe the disposition to think critically is essential for the application of CT abilities. CT dispositions refer to the tendency to think in a certain way and then choosing to do so (Norris, 1994). After extensive research, Facione, Sanchez and Facione (1994a) identified the following CT dispositions: truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness and maturity.

The study reported here was designed to evaluate the effects of a critical thinking course on CT skills and dispositions among undergraduate honors students. The objective of this project was to answer the question:

Can the use of strategies specifically targeted toward critical thinking enhance the already well-developed thinking skills of honors students?

METHODS

THE COURSE

This course, entitled: "Critical Thinking for Powerful Decision Making," was the first non-discipline-specific course devoted to the development and application of critical thinking skills at the university in which the study took place. Content focused on material with high emotional and personal appeal with emphasis on CT development through active student participation. By the end of the semester, students were expected to: a) improve their habits for effective and creative thinking; b) critically examine errors in perspective and judgment; c) enhance their ability to identify and solve problems; and d) evaluate their own responses for soundness and validity. Requirements included an issues paper, personal journal, group debate, and individual student participation.

At the beginning of the course, students were randomly assigned to interdisciplinary collaborative groups. These groups of 4-5 students worked throughout the semester on CT projects and reported their viewpoints and perspectives to the class for discussion on a regular basis.

EVALUATION PROCEDURES

Several procedures were utilized to evaluate the effectiveness of the teaching strategies. Students enrolled in the course completed the California Critical Thinking Skills Test (Facione & Facione, 1994) and the California Critical Thinking Dispositions Inventory (Facione, Sanchez & Facione, 1994b) at the beginning and end of the course.

The California Critical Thinking Skills Test (CCTST) is a highly sophisticated test based on the Delphi definition of critical thinking and is a particularly useful evaluation tool in conjunction with a CT course (Rane-Szostak & Robertson, 1996). The California Critical Thinking Dispositions Inventory (CCTDI) is the first objective method to measure the dispositional dimension of CT. It not only identifies the disposition toward thinking critically in each of the identified areas but also indicates opposition to a particular disposition. Both instruments have been used extensively in colleges and universities in the United States and other countries (California Academic Press, 1995).

DATA ANALYSIS

Pre- and post-test differences for the CCTST and CCTDI were analyzed using t-tests. The level of significance for the CCTST was set at $p = 0.1$, whereas significance for the CCTDI was set at $p = 0.05$. The investigators reasoned that, because the students in this seminar were all junior honors students, initial CT skills for this group were projected to be—and in fact were—higher than national norms. This honors group began with a total mean score of 21.16 out of a possible perfect score of 34, in contrast to the national norm for college students of 15.89. Thus, with limited room for gain, the investigators determined that a statistically significant difference of 0.1 between pre-and post-test scores would be appropriate. CT dispositions, on the other hand, were not expected to be—nor were they—markedly different in this honors group than norms for other baccaluareate students. Therefore, the significance level for CT dispositions was set at the more traditional $p = 0.05$.

For both measures, results were analyzed first for the group as a whole, then by major, gender and age. For the analysis by major, students from liberal arts, fine arts, psychology, and professional studies ($n = 9$) comprised the Arts group. Students from computer science, business, accounting, and science ($n = 10$) comprised the Science group. Gender distribution was fairly equal (11 females, 8 males). Because three students were over the age of 30, additional analysis was conducted controlling for age.

In addition to the objective measures noted above, students completed a course evaluation. An evaluation tool, specifically developed for this project, provided both quantitative and qualitative data related to course objectives and personal critical thinking development.

RESULTS

Outcomes of this course were extremely positive. Students showed statistically significant improvement in critical thinking skills as well as in the disposition to use them (Tables 1 & 2).

CRITICAL THINKING SKILLS

The class as a whole demonstrated statistically significant improvement in total score on the CCTST between the beginning and the end of the course ($p = 0.0897$). Significant improvement in subscale scores was demonstrated in: Inference ($p = 0.0878$); Reasoning ($p = 0.0610$); and Deductive Reasoning ($p = 0.0822$). Results for all measures of the CCTST are summarized in Table 1.

When results of the CCTST were analyzed by major, the Arts group showed non-significant improvement in all areas. The Science group had significant improvement in Deductive Reasoning ($p = 0.0271$) and non-significant improvement in nearly all other areas. In Evaluation and Inductive Reasoning, scores decreased fractionally; however, this change was not significant.

Mean scores for gender differed from the group as a whole. Females ($n = 11$) had non-significant improvement in all areas. Males ($n = 8$), on the other hand, showed significant improvement in overall skills ($p = 0.0942$), Inference ($p = 0.0246$), and Reasoning ($p = 0.0698$). They had non-significant improvement in the remaining subscales.

Further analysis controlled for age. When the three students over the age of 30 were excluded, results were statistically significant only for Deductive Reasoning ($p = 0.0968$). The remaining group ($n = 16$) showed non-significant improvement in scores for all other areas.

CRITICAL THINKING DISPOSITIONS

There was dramatic improvement between pre- and post-test scores for the total CCTDI ($p = 0.0001$) and for all subscales: Truthseeking ($p = 0.0029$); Open-mindedness ($p = 0.0030$); Analyticity ($p = 0.0012$); Systematicity ($p=0.0042$); Self-Confidence ($p = 0.0002$); Inquisitiveness ($p = 0.0034$); and Maturity ($p = 0.0046$). Results for all measures of critical thinking dispositions are summarized in Table 2.

In the analysis by major, the Arts Group had statistically significant

improvement from pre- to post-testing for overall CT dispositions and all subscales, except for systematicity. The Science Group improved significantly on all scales, except for Truthseeking and Inquisitiveness. In all areas, mean pre- and post-test disposition scores were higher for the Arts Group than the Science Group.

Gender analysis showed that females (n = 11) improved significantly between pre- and post-testing for the total CCTDI and all subscales, except for systematicity. Scores in Inquisitiveness and Maturity were higher for females at both pre- and post-testing than they were for males. In contrast, the males (n = 8) had higher pre- and post-test mean scores for the total CCTDI, as well as for Analyticity, Systematicity, and Self-confidence, with significant improvement on all scales except for Open-Mindedness and Analyticity. When data were analyzed controlling for age, age was not a significant factor.

Student Evaluation

Quantitative student evaluation consisted of Likert-type ratings for several areas of critical thinking. All of the students agreed or strongly agreed that the course provided a framework for thinking logically and critically, and helped increase their CT abilities. Nearly all of the students (18/19) indicated that this course was stimulating, appropriately focused for the development of decision making abilities, helpful in their lives outside the University and taught at a level appropriate for honors students. The vast majority of students (17/19) felt the course was helpful in their other courses and helped them develop a greater understanding of their own values and ethical standards. They did not feel it should have been more discipline specific (Table 3).

For the qualitative evaluation, students were asked to make general comments about the course as a whole. These comments were overwhelmingly positive and indicated students felt the course was of great benefit to them. One person wrote: "... [the course] gave me great insight into the type of thinker I want to become," and another said it was the "most informing honors course I've taken."

Students also were asked to indicate strengths and weaknesses of the course and to suggest improvements. Thirty percent of these comments (17/56) focused on how the course had improved critical thinking ability. Students indicated that the course "gave [them] the tools to think critically

and make better decisions" and that "the most valuable part [was a] greater understanding of [one's] own values and ethics." One student wrote "This class overall helped me with my other studies and helped me to think critically about life in general."

Students cited working in collaborative groups as an important strength of the course (n =13). Comments included: "The group format helped tremendously in making us realize that we are error-making individuals," and "Working in groups was the best way of helping increase thinking and disposition skills because you were in a diverse group of thinkers and had to provide support for your views."

Of the 29 comments made about the weaknesses of the course, none related to critical thinking. A key theme was needing more time for class activities. Most of the 28 suggestions for improving the course centered on structure, rather than content. Students suggested increasing the time for group presentations, group debates, and exploring issues.

TEACHING STRATEGIES

Students evaluated specific teaching strategies in relation to increasing their CT skills and dispositions. Working in the same collaborative group, writing an issue paper, and participating in group debates were given the strongest ratings. The "fish bowl" dialogue was also given very high ratings. In this exercise, several students were assigned roles within a group discussion. Other students were observers whose tasks included identifying CT skills used, errors in thinking and the impact of the various roles on a group discussion (Robertson & Rane-Szostak, 1996).

Another strategy was the deliberate creation of a relaxed atmosphere and "safe" environment. This was intended to develop and encourage students' dispositions to utilize their existing and developing CT skills.

Most of the qualitative responses relating to teaching strategies (n = 34) focused on the environment created within the classroom. Students felt the group format (n = 12), the "interactive and safe environment" (n = 5), and an "innovative," "hands on" approach (n = 4) were strengths of the course. The use of varied and creative application exercises, such as debates and video discussions to critique, were also considered to be a strength (n = 6). Students said these exercises " . . . helped me apply critical thinking to my own life," and "Creativity exercises and lateral thinking were excellent topics to look at problems in new ways."

CONCLUSIONS

Honors students tend to be good thinkers. However, while they are "intuitively" good thinkers, they may benefit from learning strategies to help them structure their critical thinking for more consistency. The statistically significant improvement on the skills test, from the already high initial scores to a mean of 22.47 after intervention, suggests that, for this group, that was indeed the case.

In evaluating these results in terms of the disposition to use CT, it is important to keep in mind that nearly all pre-test scores on the total CCTDI were higher than the normative cut off score of 280. This suggests these honors students did not have serious dispositional deficiencies. However, in looking at the subscales of this instrument, several students initially scored below the normative cut off of 40 for Truthseeking, Systematicity, Self-confidence, Inquisitiveness, and Maturity. Scores below 40 suggest potential opposition to these dispositions, which is fairly typical of college students. College students are generally open-minded and have little difficulty acknowledging others' viewpoints. However, they are less likely to critically examine viewpoints that differ from their own in an effort to uncover "truth." College students also exhibit less self-confidence and maturity than later in life (Facione, Sanchez & Facione, 1994).

Interestingly, on the dispositions post-test, total scores for these honors students increased dramatically—approaching a mean of 350. These later scores suggest strength in all dispositional areas. Also, far fewer students scored below the 40-point cut off on the above subscales. Their improvement appears directly related to this critical thinking course. Maturation should not have been a major factor after just one semester at the junior level.

In comparing majors, the Arts and the Science groups differed considerably in terms of skills and dispositions. The Science group had higher mean scores for the total CCTST and the Evaluation, Reasoning and Deductive Reasoning subscales. In contrast, the Arts group had higher mean scores in all dispositional areas. Perhaps this reflects the more structured view of the world imposed by the precise theoretical nature of science.

There were also gender and age differences on both CT skills and dispositions. Even though both men and women improved their overall and subscale scores on the CCTST from the beginning to the end of the

course, the men consistently scored higher than the women on the total test and all subscales. The men also had statistically significant improvement in total score to a mean of 24.25—nearly ten points above the national average. In the area of dispositions, men were more analytical, systematic, and self-confident, whereas women were more mature and inquisitive. It is interesting to note that all six scores below the normative cut off score on the Self-confidence scale were from women. These gender differences may be a result of socialization and imposed roles within our society. Age was only a factor for skills; it did not appear to have any influence on dispositions.

This study provides information potentially useful for the improvement of honors education. In courses not specifically devoted to CT, specific strategies to develop these skills and an atmosphere encouraging critical thinking should enhance the development of both CT skills and dispositions. However, as the literature suggests, gains are expected to be most pronounced following a specific course in critical thinking. The outcomes of this project suggest that, even for honors students, an emphasis on specific CT strategies can help to significantly improve critical thinking skills and the disposition to use them.

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TABLE 1

CALIFORNIA CRITICAL THINKING SKILLS TEST

	All Students (n=19)	Arts Group (n=9)	Science Group (n=10)	Male Gender (n=8)	Female Gender (11)	Age < 30 (n=16)
Total Score						
Test 1	21.26	20.56	21.90	22.88	20.09	20.88
Test 2	22.47	22.11	22.80	24.25	21.18	21.88
Maximum = 34						
Significance	0.0897*	0.1746	0.1584	0.0942*	0.2146	0.1635
Analysis						
Test 1	5.32	5.56	5.10	5.75	5.00	5.25
Test 2	5.79	5.89	5.70	5.88	5.73	5.63
Maximum = 9						
Significance	0.1439	0.3098	0.1644	0.4252	0.1167	0.2226
Evaluation						
Test 1	8.68	7.89	9.40	9.50	8.09	8.50
Test 2	8.95	8.56	9.30	9.75	8.89	8.69
Maximum = 14						
Significance	0.3071	0.1802	0.4475	0.3341	0.3681	0.3801
Inference						
Test 1	7.26	7.111	7.40	7.63	7.00	7.13
Test 2	7.84	7.89	7.80	8.88	7.09	7.56
Maximum = 11						
Significance	0.0878*	0.1503	0.1997	0.0246*	0.4357	0.1834
Reasoning						
Test 1	19.11	18.22	19.90	20.88	17.82	18.69
Test 2	20.26	19.78	20.70	22.13	18.91	19.75
Maximum = 30						
Significance	0.0610*	0.1404	0.1050	0.0698*	0.1722	0.1070
Deductive						
Test 1	10.11	9.78	10.40	11.25	9.27	9.81
Test 2	10.84	10.33	11.30	12.25	9.82	10.50
Maximum = 16						
Significance	0.0822*	0.2919	0.0271*	0.1262	0.2111	0.0968*
Inductive						
Test 1	9.05	8.44	9.60	9.63	8.64	8.94
Test 2	9.42	9.44	9.40	9.88	9.09	9.25
Maximum = 14						
Significance	0.2368	0.1139	0.3755	0.3780	0.2551	0.2931

* = Significant ($p = < 0.1$)

TABLE 2

CALIFORNIA CRITICAL THINKING DISPOSITIONS INVENTORY

	All Students (n=19)	Arts Group (n=9)	Science Group (n=10)	Male Gender (n=8)	Female Gender (11)	Age <30 (n=16)
Total Score						
Test 1	318.89	328.56	310.20	325.88	313.82	312.63
Test 2	349.11	366.56	333.40	350.50	348.09	343.31
Maximum =420						
Significance	0.0001*	0.0032*	0.0088*	0.0014*	0.0046*	0.0005*
Truthseeking						
Test 1	41.89	43.00	40.90	42.75	41.27	40.56
Test 2	47.63	51.67	44.00	46.75	48.27	46.69
Maximum = 60						
Significance	0.0029*	0.0131*	0.0681	0.0377*	0.0187*	0.0062*
Open-mindednes						
Test 1	47.32	49.00	46.20	48.00	46.82	47.13
Test 2	51.53	54.33	49.00	50.75	52.09	51.13
Maximum = 60						
Significance	0.0030*	0.0103*	0.0064*	0.0613	0.0013*	0.0013*
Analyticity						
Test 1	45.58	46.22	45.00	48.88	43.18	44.81
Test 2	49.84	52.00	47.90	51.38	48.73	49.25
Maximum = 60						
Significance	0.0012*	0.0094*	0.0388*	0.0889	0.0038*	0.0023*
Systematicity						
Test 1	43.74	45.11	42.50	45.63	42.36	42.31
Test 2	47.11	48.56	45.80	49.13	45.64	45.75
Maximum = 60						
Significance	0.0042*	0.0667	0.0138*	0.0128*	0.0506	0.0092*
Self-confidence						
Test 1	44.47	45.22	43.80	46.25	43.18	43.63
Test 2	50.16	52.22	48.30	51.88	48.91	49.69
Maximum = 60						
Significance	0.0002*	0.0020*	0.0248*	0.0025*	0.0114*	0.0006*
Inquisitiveness						
Test 1	48.58	50.33	47.00	47.50	49.36	47.56
Test 2	52.37	54.44	50.50	63.43	53.64	51.38
Maximum = 60						
Significance	0.0034*	0.0124*	0.0563	0.0264*	0.0282*	0.0083*
Maturity						
Test 1	47.32	49.67	45.20	46.88	47.64	46.63
Test 2	50.47	53.33	47.90	50.00	50.82	49.44
Maximum = 60						
Significance	0.0046*	0.0345*	0.0443*	0.0255*	0.0428*	0.0216*

* = Significant at $p = < 0.05$

TABLE 3

STUDENT EVALUATION OF COURSE CONTENT

The content of this course:	Strongly Disagree	Disagree	Agree	Strongly Agree
1)...was sufficiently stiumlating to hold my iinterest.		1	13	5
2)...was at an appropriate level for honors students.	1		9	9
3)...was appropriately focused to help me further develop my decision making abilities.		1	9	9
4)...provided me with a framework for thinking logically and critically.			9	10
5)...helped me increase my abilities to think logically and critically.			7	12
6)...helped me develop a greater understanding of my own values and ethical standards.		2	5	12
7)...has been helpful to me in other courses I am taking this semester.		2	10	7
8)...has been helpful to me in my life outside of the University.		1	11	7
9)...was too general to be of use in my career. It should have been more specific to my chosen discipline.	10	9		

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