Enhancing Critical Thinking in Online Learning

Abstract

This study compared critical thinking in undergraduate students via case study learning under two methods: (1) individual student analysis and (2) computer-supported collaborative analysis. Case-based learning was used as an instructional strategy to engage and motivate undergraduate students enrolled in a course designed to increase academic success and retention. Case study learning increased critical thinking skills under both conditions.
Students need higher order reasoning skills to cognitively manage the increasingly complex ways we communicate, collaborate, and work with others, even in geographically disparate locations (Halpern, 1995). “A literate person must not only excel in reading and writing text, but also must be able to listen and speak, and read and write fluently through text, images, motion video, charts and graphs, and hypertext across a wide range of media” (North Central Regional Educational Laboratory, 2003, ¶9). In addition, individuals must be able to manage a vast array of resources within complex network systems. “The sheer magnitude of human knowledge, world globalization, and the accelerating rate of change due to technology necessitates a shift in our children’s education—from plateaus of knowing to continuous cycles of learning” (North Central Regional Educational Laboratory, 2004, Executive Summary, ¶7).

Finding an agreed upon definition of critical thinking is daunting. Critical thinking has become a “mystified concept” due to its abstract nature and lack of common understanding. “Ask twelve psychology faculty members to define the term critical thinking, and you may receive twelve overlapping but distinct definitions” (Halonen, 1995, p. 75). The mystification of critical thinking has led to a multitude of definitions.

When reviewing the literature on critical thinking, reference is frequently made to Bloom’s taxonomy of educational objectives. The levels above knowledge and comprehension are considered critical thinking (Bloom, 1956). The cognitive domain with definitions are as follows:

- **Knowledge** – recalling previously learned data
- **Comprehension** – understanding the meaning of information
- **Application** – using previously learned information in new ways to solve problems
- **Analysis** – taking apart information into component parts and examining their function within the whole
- **Synthesis** – putting parts together to produce a new and original whole
- **Evaluation** – making value judgments based upon information

Gleaning information from 46 critical thinking experts, a Holistic Critical Thinking Scoring Rubric (Facione & Facione, 1994) was developed—the tool used in this study to measure critical thinking. According to Facione, the ideal critical thinker:

- Is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and circumstances of inquiry permit (Education Development Center, Inc., 1990).

Forty-five years after the publication of Bloom’s taxonomy, Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, & Wittrock (2001) revised the taxonomy into a two-
dimensional framework: a Knowledge dimension and a Cognitive Process dimension. Within the Knowledge dimension, “a fourth, and new category, Metacognitive Knowledge [was created and] . . . involves knowledge about cognition in general as well as awareness of a knowledge about one’s own cognition.” Within the Cognitive Process dimension, “three dimensions were renamed, the order of two was interchanged, and those category names retained were changed to verb form to fit the way they are used in objectives” (Krathwohl, 2002, p. 214).

Due to the complex nature of critical thinking and difficulty in assessing it, few empirical studies investigating critical thinking development in undergraduate students exist (Pithers, 2000). The few that do exist are not promising in relation to higher education’s success in promoting critical thinking in students. In a study assessing the critical thinking skills of 256 university students through the use of the Critical Reasoning Test, Pithers & Soden (1999) found no significant between-group differences in critical thinking for graduate versus nongraduate students or for the stage of the course the students were within the program. The authors purport the absence of significance is due to a lack of clarity surrounding the construct of critical thinking and reliable methods to assess it, as well as a primary instructional focus on subject-matter content. Similar findings are supported within a Teaching of Psychology special issue on critical thinking. “A majority of students still demonstrate characteristics that correspond to a concrete thinking level rather than use formal-reasoning principles that Piaget ascribed to adult thinkers” (de Sanchez, 1995, p. 72).

Other studies also support the view that adults do not necessarily develop critical thinking skills as a natural part of development. According to de Sanchez (1995), Arons (1979) and Whimbey & Lochhead’s (1986) studies found that students “have difficulty in defining and resolving problems, changing focus, considering alternatives, and defining strategies” (p. 73). The deficiencies in thinking skills may be attributed to instruction emphasized by memorizing unrelated and disconnected bits of information. Students conditioned in this type of learning often build “weak, rigid, and stereotyped thinking schemata, which results in stagnation, routine and superficial intellectual designs, and low cognitive levels” (de Sanchez, 1995, p. 73).

There is a move in education from a view of learning as the ability of students to receive and reproduce information to the ability of students to critically evaluate and synthesize knowledge within contextual and relevant learning environments (Gagnon & Collay, 2001). Constructivism embraces the idea that knowledge is not transmitted from teacher to student but is actively constructed as students engage in meaningful learning experiences. “Constructivist refers specifically to the assumption that humans develop by engaging in the personal and social construction of knowledge…Thus, humans construct knowledge; we do not receive and internalize predigested concepts without simultaneously reacting to them and engaging them within our own mental maps and previous experience” (Schmuck, 2001, p. x). Constructivists emphasize the dynamic nature of learning and the active construction of knowledge as students engage in authentic tasks situated within relevant learning contexts. The emphasis is “on learning rather than teaching, and on facilitative environments rather than instructional goals” (Collins, 1996, p. 347).
Case-based instruction is an “active-learning pedagogy designed for problem analysis and problem-solving, stressing a variety of viewpoints and potential outcomes” (Cranston-Gingrass, Raines, Paul, Epanchin & Roselli, 1996). Cases may be integrated into virtually any discipline. Well-written cases motivate and engage students as they analyze relevant issues from multiple perspectives. Experiential learning through case study learning is “likely to foster students’ learning on a higher-order level, such as their critical thinking ability and propensity for self-direction in learning” (Kreber, 2001, p. 217).

Technology facilitates the process of critical thinking in collaborative problem-solving through the communication support it offers. Dialogue and collaboration are supported through computer conferencing technologies allowing students to “examine their joint assumptions and share mental models of thought” (Pellegrino, 1995, p. 12). Computer conferencing technologies help in managing the complexities of collaborative analysis by providing a written transcript of the dialogue, easing the cognitive load involved in referencing, searching, and updating the conversation. The act of writing provides the opportunity for deep reflection and revision of ideas. The written format also makes the students’ tacit knowledge public. Faulty thinking, naïve conceptions, and errors in understanding are likely to be found and corrected (Klemm, 2002).

Asynchronous learning networks expand the time and space limitations of the classroom, allowing for student discourse outside of the classroom, virtually at any time. The written dialogue provides documentation of student participation in the forum, easing the assessment process (Kemery, 2000) and makes students’ participation and contributions public, promoting pride of ownership (Klemm, 2002).

**Method**

A nonequivalent (pretest and posttest) control-group research design (Campbell & Stanley, 1971) was used. The independent variable, the case study analysis method, had two treatment levels: (1) individual case study analysis, and (2) collaborative asynchronous computer mediated analysis. The treatment groups analyzed three case studies over a three-week period. The comparison group analyzed the case studies individually, and the experimental group analyzed the case studies collaboratively using asynchronous computer-mediated technology. Case study analyses were assigned as homework under both instructional methods. A Holistic Critical Thinking Scoring Rubric (Facione & Facione, 1996) was used to measure critical thinking—the dependent variable.

**Participants**

The participants of the study were 80 undergraduate students enrolled in a course designed to increase academic success and retention in college. Most were first semester freshmen, conditionally admitted to the university and required to take the course. Approximately one-half of the students analyzed the case studies individually, and one-half analyzed the cases collaboratively using an online discussion board.

**Apparatus**

Case studies related to academic self-regulation were used as prompts to stimulate higher order reasoning. The cases included *real world* issues faced by many undergraduate students, such as self-regulation of performance and motivation, time management, and use of deep learning strategies (Phye, 1997; Dembo, 2000).

**Procedure**

Pretests were scored using the Holistic Scoring Rubric. Graded pretests were returned to students for review, and large group discussion followed to identify the cognitive processes involved. Case analysis templates listing Knoop’s (1984) problem-solving steps were given to students for review. The template was a paper copy of the web-based form students would be completing online in future case study homework assignments. The template included the following steps:

1. Identify the problem.
2. Determine the underlying causes and symptoms of the problem.
3. Identify any unstated assumptions you are making and determine whether they are justifiable.
4. Brainstorm and list several strategies for resolution of case.
5. Evaluate each alternative, and then choose and rank your top 3 strategies according to effectiveness.
6. List your top 3 recommendations and present a rationale for each.

**Results and Discussion**

**Screening and Statistical Analysis**

The pretest and posttest measures for critical thinking were examined for normality by using skewness and kurtosis coefficients (*z*-tests of greater or less than 1.96) and the Shapiro-Wilks test where indicated. Homogeneity of variance was examined across the treatment and control groups by the (dependent) variable by using the Levene test (*α* = .05) for univariate homogeneity of variance. Pretest and posttest scores did not violate the assumption of normality; therefore, parametric tests were used to compare the means of the two groups.

**Analysis of Question 1**

Will the depth of critical thinking significantly improve for students analyzing case studies collaboratively using asynchronous computer-mediated communication and within students analyzing case studies individually. In order to test question 1, paired samples t-tests and one-within repeated measure analyses were conducted across two measures: pretest and posttest (Maxwell & Delaney, 1990; Stevens, 1996; SPSS, 2003). Since the critical thinking scoring rubric was created as an ordinal scale, nonparametric tests were also conducted to compare the obtained results from the parametric tests. The Wilcoxon Matched-pairs Signed-rank Test was used for data analyses. In all, analyses of the results of the nonparametric and parametric
analyses agreed. Significant gains in critical thinking were detected within both the treatment and comparison groups. The mean difference within pretest and posttest scores for the experimental group was -0.528, p < .05, with an effect size of .736 standard deviation units. The mean difference between pretest and posttest scores for the comparison group was -.574, p < .05, with an effect size of .635 standard deviation units.

**Analysis of Question 2**

Will the depth of critical thinking be significantly higher in students analyzing case studies collaboratively using asynchronous computer-mediated communication than in students analyzing case studies individually? In order to test question 2, a one-way analysis of variance was conducted using the posttest scores (Maxwell & Delaney, 1990; Stevens, 1996; SPSS, 2003). Since the Critical Thinking Scoring Rubric was created as an ordinal scale, a nonparametric test was also conducted to compare the obtained results from the parametric tests. The Mann-Whitney U Test was used for data analyses. In all, analyses of the results of the nonparametric and parametric analyses agreed. No significant mean differences in critical thinking were detected between the treatment group (online collaborative discussion) and the comparison group (traditional individual assignment) as measured by the Holistic Critical Thinking Scoring Rubric.

**Discussion**

Students in both treatment groups significantly improved in the depth of their critical thinking as measured by the Critical Thinking Scoring Rubric from pretest to posttest. This supports the idea that critical thinking is a skill that can be taught and improved upon within a fourteen-week semester. Several factors explain this gain. First, relevant and interesting case studies were used to motivate the students and initiate the analytical cognitive processes. Second, students were directly instructed in the steps required for the case analyses and provided with a template of the steps. Third, students received timely feedback on their analytical reasoning through in-class discussions as well as written feedback on individually graded essays. Fourth, students had ample practice analyzing a total of five case studies from pretest to posttest.

It was expected that the online collaborative discussion would enhance students’ scores from the opportunity to view issues from multiple perspectives more than students analyzing the cases individually. Perhaps the classroom discussions following each case equalized the groups in providing the students not engaged in collaborative online learning the multiple perspective component expected to be present only in the online collaborative method. This “compensatory equalization of treatments” (Gall, Borg, & Gall, 1996, p. 472) may have obscured the effects of the experimental treatment. It was also expected that the extended think time afforded by asynchronous online discussions would enhance critical thinking.

The findings support the concept that critical thinking can indeed be taught. Students can improve their critical thinking skills within the course of a semester through participation in online collaborative case study learning. This strategy affords students the opportunity to develop and practice higher order reasoning, interpersonal and written communication, and technological and self-regulatory skills. The findings of this study also challenge the perception that face-to-face instructional strategies are better than computer-supported.

References


