

Using the Four-Questions Technique to Enhance Critical Thinking in Online Discussions

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Abstract

This article describes the effect of a four-questions technique used to enhance critical thinking in online discussions. Students in a graduate educational psychology course participated in three online asynchronous discussions in reaction to case studies. Prior to the second discussion only, students responded to questions designed to encourage critical thinking through the four-questions technique of analyzing, reflecting, applying, and questioning. The researchers measured evidence of critical thinking by rating students' comments in an online discussion with The Washington State University Critical and Integrative Thinking Scale. Results suggest that the four-questions technique is effective in enhancing critical thinking in online discussions.

Keywords: online learning, online asynchronous discussions, active learning, measurement of critical thinking, higher education, teaching educational psychology

An important goal in education is to develop and enhance learners' abilities to think critically about their knowledge, their actions, and their beliefs. Critical thinking is a purposeful and reflective process in which learners engage in "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" (Scriven & Paul, 1987). Critical thinking has been considered a valuable tool for teaching and learning since the time of Socrates. More recently, researchers and educators (Astleitner, 2002; MacKnight, 2000; McKendree, Small & Stenning, 2002) have described the need for critical thinking as important as ever, particularly in today's information age. With access to more and more information, students' must be able to analyze that information systematically to solve unique problems.

Mandernach, Forrest, Babutzke & Manker (2009) found a strong body of research that shows critical thinking is enhanced through instructional strategies that promote active learning. Bonwell and Eison (1991) define active learning as "anything that involves students in doing things and thinking about what they are doing" (p. 2). Most experts agree that "active learning," or essentially learning by doing, is

effective (Smart & Csapo, 2007). Walker (2003), for example, described how active learning techniques such as questioning and written assignments lead to critical thinking. Stevens & Brenner (2009) also demonstrate that active learning strategies are essential for critical thinking through research indicating that student nurses who used active learning approaches in their education improved their critical thinking skills. Through her case studies from four institutions of higher education Tsui (2002) found that active learning strategies promoted critical thinking.

An instructional strategy that promotes active learning (and thus critical thinking) is the “four-questions technique” created by Dietz-Uhler & Lanter (2009). Although the authors recognize that various forms of active learning promote deeper thinking, they were unable to find a single instructional technique that incorporates multiple forms of active learning. To fill this gap, they developed the following four questions that fostered analyzing, reflecting, relating, and questioning:

1. “Identify one important concept, research finding, theory, or idea in psychology that you learned while completing this activity.” (analyzing)
2. “Why do you believe that this concept, research finding, theory, or idea in psychology is important?” (reflecting)
3. “Apply what you have learned from this activity to some aspect of your life.” (relating)
4. “What question(s) has the activity raised for you? What are you still wondering about?” (questioning).

In their study, Deitz-Uhler & Lanter examined the effect of these four questions on learning as measured by quiz performance. The 107 participants in an introductory psychology course participated in a web-based interactive activity followed by a quiz. The investigators compared students who completed the four questions before the quiz with those who did not complete the four questions before the quiz. Students who responded to all the questions prior to the quiz did better on the quiz than those who did not respond to the questions before the quiz. The authors concluded that asking students to think about content in a variety of ways promoted learning and deeper thinking.

Instructional techniques that promote active learning and thus critical thinking such as the four-questions technique are worthwhile in all learning environments. However, active learning techniques may be particularly important in the online environment where opportunities for interaction may be lacking. Even with Internet communications such as e-mail and chat rooms, online courses may have limited learner-to-learner interaction and instructor-to-learner interaction that often comes with the face-to-face communication and immediate feedback in traditional settings (Arbaugh, 2001; Kim, 2004; Nguyen & Kira, 2000). In their review of online instruction research, Tallent-Runnels et al (2006) state that a key component of online instruction is providing opportunities for interaction among learners. However, Garrison & Cleveland-Innes (2005) noted that simple interaction in online learning is not adequate to promote deep learning. Their research findings indicate that online learning activities should be structured so that learning occurs in a critical way. They recommend that online learning techniques incorporate reflective and collaborative properties to foster critical thinking in learners. Tallent-Runnels et al (2006) note that instructor-developed guiding questions and student-to-student interaction allow students to focus on topics and enhance their reasoning.

While Dietz-Uhler & Lanter (2009) used the four-questions technique to enhance quiz performance as part of a face-to-face learning environment, we used the four-questions technique to promote critical thinking in an online learning environment. In this study, students participated in three online discussion forums in response to case studies on behaviorism, social cognitive theory, and metacognition. While the online discussion forums foster student-to-student interaction, this study focused on whether an adaptation of the four-questions technique would also promote interactions with high evidence of critical thinking. After each one of the three discussion forums, evidence of critical thinking was measured by rating students' comments according to a validated critical thinking rubric (The Center for Teaching, Learning & Technology at Washington State University, 2009; Kelly-Riley, Anderson, Smith, Weathermon, n.d.). Only before the second online discussion on social cognitive theory did students respond to the slightly altered four-questions technique (see Method section for exact questions). The hypothesis for this study was that participants would demonstrate higher critical thinking skills in the second online discussion forum with the four-questions technique that fostered active learning than the first or third discussion forum without the four-questions technique.

Method

Participants

The participants were 24 students enrolled in two online sections of a graduate educational psychology course about learning and learners in a university in the southern United States. There were 28 students enrolled in Section 1 and 30 students enrolled in Section 2. However, only eight students from Section 1 and 16 students from Section 2 chose to participate in this study. The investigators combined the data from all students in the two sections into a single dataset.

Of the 24 participants 19 were females and 3 were males. Two participants did not identify their gender. The participants ranged from 25 to 49 years of age with a median age of 35 and a mean age of 33.1 ($SD = 6.45$). All participants of the study were enrolled in graduate education degree-seeking programs. Twenty-one participants were enrolled in Master's degree programs, one was enrolled in a Specialist's degree program, and two were enrolled in doctoral programs. Thirteen students were enrolled as full-time students and 11 as part-time students. Although many of the participants had taken online courses prior to this course, it was the first online course for five participants. The mean number of online courses completed prior to this course was 3.38 ($SD = 3.1$).

Table 1. Participant Demographics ($N = 24$)

	Mean	Range	SD
Age	33.08	25-49	6.45
Number of previous online courses	3.39	0-10	3.09

Materials

Case Studies. To facilitate the online discussions, the researchers selected three case studies from *Case Studies: Applying Educational Psychology* (Ormrod & McGuire, 2007). Each described an educational scenario in which a specific learning theory or theories and instructional principles were applied. The researchers chose one case study that focused on behaviorism, a second that related to social cognitivism, and a third that illustrated metacognition and learning. An example of the instructions that describes the case studies and the discussion forums can be found in Appendix A.

Four-questions Technique. Students were asked to complete the four-questions technique prior to the second discussion forum. The technique was based on the four-questions technique described by Dietz-Uhler & Lanter (2009) and was designed to promote critical thinking. The questions encouraged participants to: 1) analyze what was learned from the case study (*Identify and describe one important concept, research finding, or idea about social cognitive theory that you have learned.*); 2) reflect on the concepts and theories addressed in the case study (*Why do you believe that social cognitive theory is important?*); 3) relate the concepts in the case study to one's life, work, and/or studies (*Apply what you have learned about social cognitive theory to some aspect of your life*); and 4) generate questions that arose from reading the case study (*What questions has the reading raised for you? What are you still wondering about?*).

Critical Thinking Scale. The researchers measured critical thinking in the online discussions with the Washington State University Critical and Integrative Thinking Scale (WSUCITS) (Center for Teaching, Learning & Technology at Washington State University, 2006). The Center for Teaching, Learning & Technology at Washington State University (n.d.) documents use in measuring critical thinking across a variety of disciplines and applicability as a rubric for a variety of instructional methods. The scale uses a 6-point Likert scale in which the researcher rates students on seven skills. The skills are a) identify and summarize an issue, b) identify and consider contextual influences, c) develop one's own perspective, d) present supporting evidence, e) integrate other perspectives, f) identify conclusions, g) communicate effectively. The students are scored and rated either 1-2 (emerging in that element/skill); 3-4 (developing that skills); or 5-6 (mastering that skills).

A modified version of the WSUCITS was used as the rubric for grading participants during the discussion forums. The rubric used the seven dimensions from the WSUCITS. The instructor added three criteria to the rubric that were considered important for facilitating quality online discussions. They were 1) respects others' viewpoints, 2) responds in a timely manner, and 3) incorporates personal experiences. The rubric is in the Appendix B.

Procedure

Participants took part in online discussion forums related to three different case studies on behaviorism, social cognitivism, and metacognition. One discussion forum was during the second week, another at the midpoint of the semester, and the third in the next to the last week of the course. Participants were randomly assigned to groups of 5 or 6 and were not always with the same group for each discussion forum. They had five days to participate in each discussion forum.

As part of their class requirements participants completed the four questions described earlier prior to reading the case study on social cognitivism that introduced the second discussion forum. Participants did not complete the four questions prior to the first (behaviorism) and third discussion (metacognition) forums.

Results

The design of this study was a repeated measures design. A second investigator rated the discussion forums using the WSUCITS and the inter-rater reliability was 0.795.

The hypothesis was that participants would demonstrate higher critical thinking scores when they completed the four-questions than when they did not complete the four-questions. To test the hypothesis the researchers conducted one-way repeated-measures ANOVA with the dependent variable being the critical thinking scores. The means and standard deviations for the critical thinking scores are presented in Table 2. The results of the ANOVA indicated a significant effect, Wilk's $\Lambda = 0.56$, $F(3,23) = 8.13$, $p < 0.002$, partial $\eta^2 = 0.44$. Results showed that there was a significant difference between the critical thinking scores of the three discussion groups with a moderate effect size.

Table 2. Means and Standard Deviations for Critical Thinking Scores in Discussion Forums ($N = 24$)

Discussion Forums	Mean Scores	Standard Deviation
Forum #1	4.76	0.62
Forum #2	5.31	0.93
Forum #3	4.81	0.23

Follow-up polynomial contrasts indicated a significant quadratic effect $F(3,23) = 17.03$, $p = .00$, partial $\eta^2 = .44$. The linear effect was insignificant $F(3,23) = .10$, $p = .75$, partial $\eta^2 = .01$. By comparing the mean scores it is clear that the critical thinking scores did not increase or decrease in a linear fashion across the three discussion forums over time. The mean critical thinking score from the second discussion forum was higher than the mean scores from the first and third discussion forums.

Pairwise comparisons were computed among the critical thinking scores (CTscores) of the three discussion forums. The results are presented in Table 3. There were significant differences between the critical thinking scores of first (CTscore1) and second discussion forums (CTscore2), $p = .002$ and the second and third (CTscore3) discussion forums, $p = .003$. The difference between the critical thinking scores of the first and third discussion forum was not significant, $p = .747$. These results indicate that the four-questions technique enhanced critical thinking in the online discussion forum in this study. The moderate effect size suggests that the result is moderately robust.

Table 3. Paired Samples Test

	Paired Differences		T	Df	Sig. (2-tailed)
	Mean	Std. Deviation			
Pair 1 CTscore1 – CTscore2	.5522	.7669	-3.453	22*	.002
Pair 2 CTscore2 – CTscore3	.4875	.6905	3.459	23	.002
Pair 3 CTscore1 – CTscore3	-.0565	.8289	-.327	22*	.747

The researchers were interested in seeing if there was a relationship between critical thinking demonstrated in online discussions and previous online experience and if there was a relationship

between critical thinking demonstrated in online discussions and participant age. Correlation coefficients were computed between the discussion forum scores, participant age and number of previous online courses. Based on the results there does not appear to be a relationship between critical thinking scores and previous online courses completed nor a relationship between critical thinking scores and participant age in this study.

Discussion

The purpose of this study was to test the hypothesis that participants would demonstrate higher critical thinking scores in an online discussion with the four-questions technique compared to online discussion without the four-questions technique. Results suggest that the four-questions technique is effective in enhancing critical thinking in online discussions.

The researchers were also interested to see if students who had more experience in online discussions might have better critical thinking scores. The results suggest that the prior experience did not influence critical thinking scores. Additionally, the researchers were interested to see if participant age would play a role in critical thinking scores. The results indicate that age may not make a difference. Because these were not significant factors, the four-questions technique, as used in this study, appears to be effective regardless of whether learners are novice online learners or experienced online learners and equally effective regardless of learner age. Of course, this sample was small and did not incorporate random assignment of participants to different conditions.

Dietz-Uhler & Lanter (2009) used the four-questions technique to enhance learning as measured by quiz performance. In this research, the same technique was used to enhance critical thinking in online discussions. Dietz-Uhler & Lanter used their technique with undergraduate psychology students in a traditional class setting while participants in this study were graduate educational psychology students in an online learning environment. The data from this research, although limited, support the conclusion of Dietz-Uhler & Lanter (2009) that the four-questions technique may be applied to different learning situations.

Future researchers might investigate the use of the four-questions technique in facilitating critical thinking in online discussions with a larger sample size and/or use a design in which participants are randomly assigned to different conditions. An additional line of research might focus on analyzing the content of discussions online to identify indicators of critical thinking and its elements. These research designs might allow a more thorough investigation of the role of specific elements of critical thinking and enable instructors to provide focused facilitation of certain elements. Additionally, future researchers may wish to gather qualitative data from participants about their satisfaction with this teaching technique and their perceptions of how it impacted their critical thinking.

Conclusion

A goal of education is to develop and enhance critical thinking. Previous research indicates that instructional techniques that promote active learning can enhance critical thinking. The four-questions technique offers an instructional technique that effectively promotes critical thinking in online discussions.

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Appendix A: Instructions for Participation in Online Discussion

Download and read the Discussion Activity Rubric and the "Learning the Ropes" case study BEFORE you participate in this activity!

Please read and reflect on the case study, "Learning the Ropes." As you do this, look at the situation through the eyes of an educational psychologist. What theory and principles of learning are represented in this case? Describe the strategies the teacher uses and whether the strategies help or hinder the students' learning. Support your comments using concepts from the textbook, class assignments and any other readings from the literature with which you are familiar. You may use web resources for this except Wikipedia. Please include literature citations or URLs that you may use so others can add to their own

resource lists. Please describe any personal relevant experiences related to this case study.

As stated in the syllabus:

- Discussion postings are required and graded (see attached grading rubric).
- Each student is required to make a minimum of one original posting and three follow-up postings per discussion board.
- Original posting is expected on Monday, June 22 by 12:00 p.m. with a minimum three follow-up postings completed on Friday, June 26 by 12:00 p.m.

Appendix B: Rubric For Participation In Discussion Activity

Adapted from the *Guide to Rating Integrative and Critical Thinking*, Washington State University, Fall 2006

Engages in the following (one point for each area for total possible points of 10)

Identifies problem, question, or issue	
Considers context and assumptions	
Develops own position or hypothesis	
Presents and analyzes supporting data	
Integrates other perspectives	
Identifies conclusions and implications	
Communicates effectively	
Respects others viewpoints	
Responds in timely manner	
Incorporates personal experiences	

Total Points Earned:

Comments:

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