DESIGNING THE INSTRUCTIONAL PROCESS TO ENHANCE CRITICAL THINKING ACROSS THE CURRICULUM

Inquiring Minds Really Do Want to Know: Using Questioning to Teach Critical Thinking

Alison King
California State University, San Marcos

This article presents an inquiry-based approach to promoting critical thinking in psychology. Students are taught a model of inquiry and how to apply it in cooperative-learning contexts in the classroom as well as individual reading and study settings. The model emphasizes helping students develop a habit of inquiry by learning to ask thoughtful questions—of themselves and each other—about what they read in their textbooks, hear in lectures, and encounter during class discussions. Results of research on the use of this approach are presented as are the theoretical bases for the model's effectiveness.

I believe that the hallmark of a critical thinker is an inquiring mind.[1] Simply put, good thinkers are good questioners. Whatever they see, hear, read, or experience, they are constantly analyzing it, puzzling over its significance, searching for explanations, and speculating about relations between that experience and what they already know. Good thinkers are always asking What does this mean?, What is the nature of this?, Is there another way to look at it?, Why is this happening?, What is the evidence for this?, and How can I be sure? Asking questions such as these and using them to understand the world around us is what characterizes critical thinking. Isidor Rabi, the 1944 Nobel Prize winner in physics, told the story of how he learned to be a questioner as a very young boy. When he returned home from school each day, his mother, instead of asking him what he had learned in school that day (as most other mothers did), asked him what good questions he had asked that day. According to Rabi, this daily greeting from his mother had a profound influence on the development of his inquiring mind.

If good thinkers are good questioners, then is the reverse true? Are good questioners good thinkers? Do inquiring minds really want to know? If we could teach our students to ask good questions, would that improve their critical thinking? Results of my own program of research on inquiry-based learning (King, 1989, 1990, 1991, 1992, 1994a) suggest that the answer is yes.

[1]This position has been developed more fully in King (1994b).

A Model of Inquiry

The overall emphasis of the model of inquiry presented herein is on helping students develop a habit of inquiry so that they can learn to ask thoughtful questions—of themselves and of each other—about the material they read, hear in lectures, and encounter during class discussions. Such a habit of inquiry learned and practiced in class can be applied also to their everyday lives: to what they see on television, read in the newspaper, observe in the popular culture, and hear during interaction with friends and colleagues, as well as to decisions they make about personal relationships, consumer purchases, political choices, and business transactions.

Thus, the model's focus is on autonomous learning that is inquiry based. This model turns around the notion of inquiry-based instruction and places the responsibility (as well as the skill) for learning on the student. In inquiry-based instruction, the instructor asks the students leading questions to elicit from them information and inferences, predictions, and so on about that information. By contrast, in this inquiry-based learning model, students learn a skill for asking such questions on their own—autonomously—whether they are studying alone at home, working independently in class, or participating in a discussion group within the class. An important feature of inquiry-based learning is that the students are not merely searching for correct answers to the instructor's questions (which may or may not be relevant to individual students' own learning needs); rather, they are posing and answering questions that address their own lack of understanding, specific gaps in knowledge, and particular misconceptions. Because such questioning and answering activity is personally meaningful to them, students are more likely to be making the kinds of mental connections between concepts that are more memorable for them.

What Are Thought-Provoking Questions?

In any classroom, the level of thinking that occurs is influenced by the level of questions asked. We can use particular questions to induce in students whatever specific

thinking processes we wish. For example, when questions are factual (e.g., What is a schema?), the tendency is for only facts to be recalled (in this case, a memorized definition); however, when questions are thought provoking (e.g., How do schemas differ from scripts?, and Explain how a schema would facilitate problem solving in the following scenario.), then critical thinking is more likely to occur. Thought-provoking or critical-thinking questions require students to go beyond the facts to think about them in ways that are different from what is presented explicitly in class or the text. Critical-thinking questions activate critical thinking in both the questioner and the responder. More specifically, critical-thinking questions induce high-level cognitive processes, such as analysis of ideas, comparison and contrast, inference, prediction, evaluation, and the like.

Unfortunately, researchers have shown that, when students are asked to generate questions on their own, they usually pose factual rather than thought-provoking ones (Dillon, 1988; Flammer, 1981; Kerry, 1987; King, 1990). Therefore, if we want students to generate thoughtful questions spontaneously, we need to teach them how to do so. By teaching our students to ask critical-thinking questions, we can promote the development of their inquiring minds.

Guiding Students To Create Their Own Critical-Thinking Questions

We can train students to generate their own effective and relevant critical-thinking questions by providing them with the structure and guidance of exemplar questions. Table 1 contains some examples of general thought-provoking question stems and the thinking processes each is expected to induce. Students use these generic questions as prompts to guide them in formulating their own specific questions pertaining to the material to be learned. They simply adapt the generic thought-provoking question stems for use by filling in the blanks with specific content relative to the topic being covered. They are encouraged to generate questions to which they do not already know answers. In my program of research, my co-workers and I found that, when students are provided with that set of exemplar question stems (or a subset of it) and coached while they practice generating their own questions, they learn the skill very quickly and their learning is markedly enhanced (King, 1990, 1992, 1994a).

These question stems can be used in many ways by psychology students to enhance their own thinking and learning. Some applications are cooperative-learning strategies (e.g., reciprocal peer questioning), others are based on individual student use, and others combine individual learning and group learning (e.g., readers' questions—such as David Letterman's "viewer mail" questions).

Reciprocal Peer Questioning

After listening to a class lecture, my students use the generic question stems and work independently to generate two or three questions based on the lecture material. Next, in pairs or small groups, they engage in peer questioning, taking turns posing their questions to their partner or group and answering each other's questions in a reciprocal manner. Then, as a whole class, we share some of the questions and

Table 1. Guiding Critical Thinking

Generic Questions	Specific Thinking Skills Induced
What are the strengths and weaknesses of . . . ?	Analysis/inferencing
What is the difference between . . . and . . . ?	Comparison–contrast
Explain why . . . . (Explain how . . . .)	Analysis
What would happen if . . . ?	Prediction/hypothesizing
What is the nature of . . . ?	Analysis
Why is . . . happening?	Analysis/inferencing
What is a new example of . . . ?	Application
How could . . . be used to . . . ?	Application
What are the implications of . . . ?	Analysis/inferencing
What is . . . analogous to?	Identification of and creation of analogies and metaphors
What do we already know about . . . ?	Activation of prior knowledge
How does . . . affect . . . ?	Analysis of relationship (cause–effect)
How does . . . tie in with what we learned before?	Activation of prior knowledge
What does . . . mean?	Analysis
Why is . . . important?	Analysis of significance
How are . . . and . . . similar?	Comparison–contrast
How does . . . apply to everyday life?	Application to the real world
What is a counterargument for . . . ?	Rebuttal to argument
What is the best . . . , and why?	Evaluation and provision of evidence
What is a solution to the problem of . . . ?	Synthesis of ideas
Compare . . . and . . . with regard to	Comparison–contrast
What do you think causes . . . ? Why?	Analysis of relationship (cause–effect)
Do you agree or disagree with this statement: . . . ? What evidence is there to support your answer?	Evaluation and provision of evidence
What is another way to look at . . . ?	Taking other perspectives

Note. From "Comparison of Self-Questioning, Summarizing and Notetaking Review as Strategies for Learning From Lectures" by A. King, 1992, *American Educational Research Journal, 29.* Copyright 1992 by the American Educational Research Association. Reprinted by permission of the publisher. Also from *Changing College Classrooms: New Teaching and Learning Strategies for an Increasingly Complex World* (p. 24) edited by D. Halpern, 1994, San Francisco: Jossey-Bass. Copyright 1994 by Jossey-Bass. Adapted by permission.

ideas that have arisen in the small groups and discuss them further.

For example, in my educational psychology class, during our study of human intelligence, one of the topics we cover is theories of multiple intelligences. In one class session, I present material on the two theories. Then, I display the list of generic question stems on the overhead projector and ask students to select stems appropriate to their learning needs and generate two or three thoughtful questions on the topic of multiple intelligences using those question stems as a guide. After about 3 min, I signal them to turn to their neighbors, form their discussion groups, and begin the reciprocal peer questioning and responding discussion process with which they have become familiar. Some of the actual questions written by one such group are as follows:

Why is the concept of multiple intelligence important?

Explain why it is necessary—or beneficial? Who benefits? Why is it better than the old one-dimensional theory?

How does Sternberg's theory of multiple intelligences differ from Gardner's?

What are the implications of the idea of multiple intelligences for a second grade teacher in a multicultural classroom?

Compare Sternberg's theory and Gardner's with regard to their probable influence on the public schools.

How do the theories of multiple intelligences apply to everyday life?

Students continue discussing the topic of multiple intelligences by asking and answering each others' questions until I signal them to stop. Then, in the whole-class context, students share some of the ideas generated in their group discussion, and together we clarify any misunderstandings about multiple intelligences that have arisen.

In reciprocal peer questioning, it is important that students not ask and answer their questions in a rote manner without concern for fully discussing an issue before going on to another question. I have found that often within one 8- to 10-min discussion session some of the student groups have time to pose only one question because the discussion that ensues from that one question is so extensive. Asking probing follow-up questions is an effective way to extend the discussion on a particular point. For example, the second question mentioned earlier (Explain why it is necessary—or beneficial? Who benefits? Why is it better than the old one-dimensional theory?) is a follow-up question asked by the same student who posed the initial question, and this probes students to explore further into the first question asked.

Colleagues of mine (e.g., N. M. Webb, personal communication, May 1992) who have used this inquiry model report that the process can be time-consuming; however, the quality of the discussion in their classes is greatly improved. They have also noted that this questioning strategy allows students to phrase their confusions (e.g., What is the more appropriate analysis to use in this case, repeated measures or analysis of covariance, and why?) and lack of understandings (e.g., Why is that situation an example of the Piagetian construct of ego-centrism?) and receive information to address their needs. When students work in collaborative inquiry with a partner or a small group using this model, they are more willing to risk asking stupid questions or questions to which they do not already know an answer. One of the benefits of this approach is that circulating about the room listening to the small groups as they answer and discuss their questions is very helpful. It is a way for me to determine how well the class understands the material and which individual students do not. This is good feedback about my instructional process because it tells me which concepts need to be clarified and what material we need to consider longer.

Readers' Questions

Getting students to complete reading assignments before class is a perennial problem for most of us. To stimulate my students to complete their readings before class, I have them use the generic question stems shown in Table 1 to generate three or four thoughtful questions on the material as they are reading it before the class meets. At the beginning of each class session, they turn in their questions to me as an assignment (and keep a copy for themselves). I use these questions in two ways. First, I use them to stimulate discussion during that class session—rather like the questions in the "viewer mail" segment on David Letterman's television show. I shuffle through the students' questions, select ones to read aloud, and initiate either small-group or whole-class discussion. Second, when I review the questions after class, the questions that a particular student generated tell me a great deal about that student's level of understanding of the material covered—or even whether the student has actually read the material. At the end of the semester, I review each student's contribution of questions from the entire semester for quality and comprehensiveness. Furthermore, I sometimes use the questions generated by students as items on course exams (see discussion that follows).

Alternative Applications for Individual Student Use

In the individual or self-questioning version of this strategy, students use the question stems to guide them to generate their own thought-provoking questions after listening to a lecture or reading assigned material. Then, they answer those questions fully on their own. This form of questioning and answering is very useful as a way to study the material in preparation for class and exams.

Why Is This Model Effective?

These generic question stems are effective in promoting students' critical thinking because they act as cognitive prompts to induce analysis, inference, evaluation, comparison and contrast, and other high-level cognitive processes with regard to specific aspects of the material being studied (King, 1992; Pressley et al., 1992). Simply formulating the thought-provoking questions, despite whether they are answered, requires students to think critically about the material. In the process of generating such questions, students are forced to identify the main ideas presented and think about

how those ideas relate to each other and to the students' own prior knowledge and experience. When they respond to other students' critical-thinking questions (or their own), they are compelled to engage in further critical thinking because they must explain concepts, defend their ideas, give examples, and show that they really understand (Bargh & Schul, 1980; Cobb, 1988; Mugny & Doise, 1978; Webb, 1989). According to current theories of information processing, when students think about material in these ways, they process the ideas more thoroughly than if they were simply memorizing it. During this extensive processing, they are building complex cognitive networks, connecting the new ideas together and linking them to what they already know. When students develop such extensive cognitive representations of the new material, they are more likely to remember it.

The effectiveness of reciprocal peer questioning and other cooperative-learning applications of the inquiry model can also be attributed partially to theories of the social construction of knowledge. According to social constructivism (e.g., Bearison, 1982; Damon, 1983; Mugney & Doise, 1978; Perret-Clermont, 1980; Vygotsky, 1978), when we are engaged in peer interaction, we discover that our own perceptions, facts, assumptions, values, and general understandings of the material differ to a greater or lesser extent from those of others. When confronted with these conceptual discrepancies, we want to reconcile the conflicts. To do so, we must negotiate understanding and meaning. And this negotiation, this co-construction of meaning, occurs through explaining concepts and defending our own views to each other. Reciprocal peer questioning promotes this process of exposing and reconciling cognitive discrepancies by controlling the direction of the discussion. For example, when students ask and answer thought-provoking questions, such as What do you think would happen if . . . ?, they tap in to each others' different views on the matter. Once these differing views or conflicting information are exposed, individuals are requested to elaborate, explain, justify, and engage in other sociocognitive behaviors that may lead to reconciling those differences and reaching negotiated meaning. According to Cobb (1988), when we are engaged in such meaning negotiation, we are continually restructuring our own thinking.

The inquiry model also serves a metacognitive role. *Metacognition* is the awareness, monitoring, and control of one's cognitive processes. Awareness of the purpose of a task, monitoring one's attention to a lecture, selecting specific learning strategies to use, monitoring one's progress toward a goal, identifying mistakes, monitoring one's understanding all are examples of metacognition in action. Asking and answering thoughtful questions functions as a metacognitive self-testing experience, giving students the chance to monitor their understanding of the topic before moving too far into the material.

Fostering Questioning Through Modeling

We can further promote student use of these critical-thinking questions by modeling the use of such questions ourselves. Those general critical-thinking questions can be used by any instructor in any subject area to guide that instructor to ask subject-specific questions relevant to any content. Asking students to back up their assertions and examine their thinking through such questions as Why do you think so? and What is your line of reasoning here? provides further opportunity to model critical-thinking questioning. I use the question stems during class to pose questions to stimulate thinking and discussion as well as to construct examination questions and other forms of course evaluation.

Evaluation

In any course, assessment must be congruent with the kinds of learning emphasized in class. When critical thinking is emphasized and promoted during the semester, all tests, assignments, and final exams should reflect this emphasis. Specifically, such evaluation should be designed to assess students' understanding of course material, rather than their ability to recall memorized information. Therefore, exam questions should require the kinds of thinking emphasized in class sessions: explanation; analysis; and integration of concepts, theories, processes, and so on. I use the generic critical-thinking questions in constructing appropriate examination questions and other assignments for my students. I have even built an entire examination from questions students themselves have written and contributed. Why not? By the time of the final exam, they have become just as proficient as I at constructing thoughtful questions. For their course term paper, I have my students generate and answer a question of their own. Essentially, the term paper consists of their answer to a question they themselves have posed about an educational psychology topic, issue, or construct that interests them (the paper cannot be a reiteration of some part of the text, and students must use several primary sources).

Conclusion

In my educational psychology classes, I use this model of inquiry in its various applications: reciprocal peer questioning, readers' questions, and modeling. The model enhances student learning, promotes self-regulated learning, and provides students the structure and motivation to prepare well for class. The consistent feedback that I get on student evaluations of my teaching is that students really learn how to think in my class.

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Note

Requests for reprints should be sent to Alison King, School of Education, California State University, San Marcos, CA 92096–0001.

Conference-Style Learning: A Method for Fostering Critical Thinking With Heart

Marion K. Underwood
Rebecca L. Wald
Reed College

Conference teaching fosters critical thinking, *which we define as the ability to evaluate inferential networks and research designs, the confidence to listen to one's own intuitions about what matters, and the sensitivity to recognize and evaluate the goals of others from diverse backgrounds. Teachers contribute to conference-style learning by explaining expectations for classroom behavior, carefully choosing primary source readings, and molding class discussions by posing and responding to questions in strategic ways. To benefit from conference-style learning, students must read assigned materials carefully, practice formulating analytic questions, think aloud about challenging issues, and learn to respect their own intuitions and those of others. The benefits of conference-style learning far outweigh its potential risks, as students learn to practice critical but considerate thinking.*

My early experiences as a teacher reminded me of a trip to the zoo. At the St. Louis Zoo, which I visited as a child, there was a large pool with a bridge over it. In this pool was a copious number of carp; when anyone would walk across the bridge, hundreds of carp would rush over and stick their heads up with their gaping mouths wide open. My impression as a beginning teacher was that (a) even bright students often want to be fed, (b) they want to be told what is right and what to believe, and (c) it takes ingenuity on the part of teachers to engage students in more active learning and critical thinking.

Critical Thinking for Psychology Undergraduates

This article describes the *conference method*, a style of instruction that can be used to teach undergraduates to think critically about primary source materials. If there is a single goal on which most educators agree, it is that we seek to teach students skills in critical thinking. As part of a national review of arts and sciences majors undertaken by professional societies at the initiation of the Association of American Colleges, a task force of the American Psycho-