

FDC Faculty Workshop

Teaching Critical Thinking

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Presentation Summary

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Introduction.

Critical Thinking Across the Curriculum: Preliminary FAQs:

Q: Why can't the philosophy department handle all the critical thinking instruction?

A: We're generous-hearted folk.

Q: How can I teach critical thinking in my departmental courses when I can't even cover the necessary subject-matter content?

A: Embedding critical thinking in subject-matter instruction is very doable. Seriously.¹

I. What is Critical Thinking?

1. If we were to confine ourselves to the study of validity, we should be shirking the task of the "criticism of thought." For in real life we want our conclusions to be true as well as valid: irreproachable reasoning can be no substitute for well-grounded premises.

Max Black, *Critical Thinking: An Introduction to Logic and Scientific Method* (New York: Prentice-Hall, Inc., 1946), 227.

2. [W]e need to think because the world we live in, however well we learn to cope with it, is constantly forcing us to choose. When experience surprises or disturbs us, we have to "make up our minds," and, as the phrase suggests, when we do that, not only are we deciding what to do with the world about us; we are deciding what we are or want to be.

Monroe C. Beardsley, *Practical Logic* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1950), x-xi.

3. [There are] two distinctly different kinds of thinking, *creative thinking* and *critical thinking*. Creative thinking may be defined as the formulation of possible solutions to a problem or explanations of a phenomenon, and critical thinking as the testing and evaluation of these solutions or explanations.

W. Edgar Moore, *Creative and Critical Thinking* (Boston: Houghton Mifflin Company, 1967) 2, 3.

¹See Robert H. Ennis, "Incorporating Critical Thinking in the Curriculum: An Introduction to Some Basic Issues," *Inquiry: Critical Thinking Across the Disciplines* 16 (Spring 1997), 1. Ennis distinguishes between two types of embedding: infusion, where critical thinking concepts are made explicit; and immersion, where subject matter treatment is very deep and involved, but no explicit general principles of critical thinking are presented. There is a spectrum of intermediate course design between these two opposites.

4. The art of making sense involves an understanding of semantics and scientific methods of thinking, in addition to the analysis of reasoning, or logic. The “good thinker,” in other words, must make a threefold analysis of a discussion. He will interest himself in the meanings of words, he will look for the “argument” in what he reads or hears, and he will ask himself whether what he hears is true or false.

Lionel Ruby, *The Art of Making Sense: A Guide to Logical Thinking*, 2d ed.
(Philadelphia: J. B. Lippincott Company, 1968), 10.

5. In addition to the critical tasks already mentioned—namely, figuring out what language means in various contexts, determining when evidence is required to support assertions, and marshaling evidence when it is required—critical thinking also involves other abilities: thinking coherently, comprehending instructions and advice, formulating problems and solving them, judging whether bits of information are relevant to an issue, surveying possible outcomes of decisions and plans, and deciding how to make the best choices from those available.

Merrilee Salmon, *Introduction to Logic and Critical Thinking*, 4th ed. (Belmont, CA: Wadsworth, 2002), 4.

6. I am uneasy to think I approve of one object, and disapprove of another; call one thing beautiful, and another deformed; decide concerning truth and falsehood, reason and folly, without knowing upon what principles I proceed.

David Hume, *A Treatise of Human Nature*, Sect. VII.

7. Critical thinking is the intellectually disciplined process of 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.

Michael Scriven and Richard Paul, “Defining Critical Thinking: A Statement for the National Council for Excellence in Critical Thinking Instruction.”
<http://www.criticalthinking.org/aboutCT/definingCT.shtml> (16 May 2005).

8. “Critical thinking,” as I think the term is generally used, roughly means *reasonable reflective thinking that is focused on deciding what to believe or do*.

Robert H. Ennis, “Critical Thinking: A Streamlined Conception,” *Teaching Philosophy* 14 (March 1991): 6.

Some Background Basics:

A. Logic

Deductive—inductive distinction

What is an argument?

- **Identification**
 - Look for inference indicators
 - Arguments and explanations
- **Analysis**
 - Logically compound statements
 - Class statements
 - Beardsley-type arrow diagrams
 - Implicit/hidden assumptions
- **Evaluation**
 - Deductive validity: **If** all the premises are true, then it is **impossible** for the conclusion to be false.
 - Inductive strength: **If** all the premises are true, then it is **highly unlikely** that the conclusion is false.
 - Generalizations (enumerative induction)
 - Analogies
 - Probability and statistical inference
 - Casual reasoning
 - Evaluating scientific hypotheses
 - Soundness: deductively valid, plus all premises are actually true
 - Fallacies

B. Truth

- Meaning
 - Definition types
 - Fact/opinion distinction
- Reasons and causes of belief
- Relativism
 - Cultural relativism
 - Philosophical relativism
- Testimony and credibility of sources
- Experience and experimentation
- Self-evidence
- Causation and explanation
- Evaluation of hypotheses
- Inference to the best explanation

II. Critical Thinking Exercises.

I recommend that critical thinking instruction initially be very focused. Specifically, I recommend instruction be limited to (1) inference indicators and argument identification, (2) a few prominent informal fallacies (see below), and (3) assessing the truth of premises, with particular attention to the reliability of testimony. This recommendation is based on the assumption that the infusion of critical thinking across the curriculum will start out modestly and increase as faculty gain experience.

A. Field Studies in Reasoning.

Exercise title: Descriptions, arguments, and explanations.

Time required: Varies. First time requires ≥ 50 min., two or more sessions. Subsequent exercises may be much shorter, e.g., three or four sample cases at the beginning of each meeting.

Purpose: Being able to identify the reasoning of others, as opposed to description, is arguably the most basic task in improving critical thinking. Students will examine a short passage, determine whether there is reasoning in the passage (argument or explanation), and if so, what premises and conclusion(s) the author advances.

Special critical thinking tools needed for exercise: (1) definitions of “argument” and “explanation,” and (2) list of inference indicators. Skill level need not be great, but this exercise assumes that students have done simple homework regarding these two skills. Can be used in small or large sections (upper limit: 40-50). Appropriate to many different types of courses.

Procedure: Introduce a list of short passages (may, but need not, be relevant to the course content) and ask students (individually, or in small groups) to identify the reasoning, if any, in the passage. The passage may be descriptive, argumentative, explanatory, or a combination. Remind students that inference indicators are the most reliable method by which we can determine the author’s intentions, and that intermediate conclusions serve as premises for subsequent conclusions. Students should write out each statement in the passage on a separate line, prefaced with its logical function.

Critical thinking texts have hundreds of examples like those shown below. After students learn to distinguish among descriptions, arguments, and explanations, I suggest providing only passages that contain some argumentation, and then introducing passages that are primarily or exclusively explanatory.

Sample passages:

- A senior government source leaked a report of “Koran abuse” to Newsweek, and then the Pentagon denied the accuracy of the report.

- The Pentagon denied the accuracy of Newsweek's "Koran abuse" story because the denial was reported in the New York Times.
- The Pentagon denied the accuracy of Newsweek's "Koran abuse" story because it is not in the national interest that such a story be true.
- I went to the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived. (Henry David Thoreau, *Walden*)
- . . . we know that there is no greatest prime number. But of all the prime numbers that we shall have ever thought of, there certainly is a greatest. Hence there are prime numbers greater than any we shall have ever thought of. (Bertrand Russell, "On the Nature of Acquaintance")
- The deliciously creamy taste of Sealtest cottage cheese stands out no matter what you make with it. Because we make Sealtest cottage cheese with pure Sealtest sweet cream dressing for an outstandingly fresh natural flavor. That's why Sealtest cottage cheese is so good just be itself, or as a delicious ingredient. (Sealtest cottage cheese ad, *Redbook*, July 1980, as quoted in Nolt 1984, 74)
- An object offers as much resistance to the air as the air does to the object. You may see that the beating of its wings against the air supports a heavy eagle in the highest and rarest atmosphere, close to the sphere of elemental fire. Again you may see the air in motion over the sea, fill the swelling sails and drive heavily laden ships. From these instances, and the reasons given, a man with wings large enough and duly connected might learn to overcome the resistance of air, and by conquering it, succeed in subjugating it and rising above it. (Leonardo da Vinci, *Notebooks*)

B. Questioning.

Exercise 1 Title: "Single-meeting questions."

Time required: \geq 30 minutes.

Purpose: Questioning is fundamental to teaching critical thinking. It serves to promote (in both the questioner and responder) active thought, insight, challenging of assumptions, consideration of alternative hypotheses, seeing an issue from the perspective of another person, investigating the reliability of sources, and the stimulation of reasoning.

Special critical thinking tools needed for exercise: None. Can be used in small or large sections (upper limit: 40-50). Appropriate to many different types of courses.

Procedure: Introduce lecture topic and ask students (groups of 3-6) to prepare a brief written statement concerning the topic with respect to reading and homework. Groups are then questioned by instructor. The statement can be descriptive or argumentative. Example: "Briefly describe channel gating during an neuron action potential."

Sample initiating questions: Depends on subject matter and student responses.

Example 1: “If all neural impulses are basically the same voltage cascade, then how can touching a warm surface with a finger feel different than pricking a finger on a thorn?”

Example 2: “How can an increase in Federal spending reduce unemployment?”

Sample quick-response questions:

- What do you mean by the word such-and-such?
- Would you say some more about that?
- How do you respond to the statement that such-and-such?
- Would you restate your point again?
- What assumption behind your statement/claim is the most important?
- Why should we trust/distrust the source you cite as evidence for your claim?

Exercise 2 Title: “Long-term questions” (e.g., 2-3 per semester-long course).

Purpose: Provides a basis for extended critical analysis of a question including research and evaluation of sources, consideration of alternative hypotheses, development of evidence, use of deductive techniques, etc.

Special critical thinking concepts needed for exercise: argument, explanation, premise, conclusion, reliability of testimony, explanatory adequacy. Also needed: open-ended set of concepts determined by course objectives, instructor preparation, etc. Can be the basis for a course focused on critical thinking, e.g., first-year seminar, upper division special topics course in the major, etc.

Procedure: Introduce question and then guide students through structured analysis of the question over several days or weeks using various critical thinking tools.

Sample questions:

- Was dropping the bomb necessary to end the war with Japan (after R. Swartz, n.d.)?
- How do you know that the earth is round (after Black 1946, 245)?
- Is Polonius a silly old fool (Ennis 1996, 233)?
- Can the earth be protected from catastrophic asteroid impact?
- Is alcoholism a disease?
- Did the first Polynesians come from South America?
- Were the violent acts of September 11, 2001, acts of war?

C. Fallacies.

Fallacies are fairly easy for students to learn, but can be more difficult to identify in context. Nonetheless, students comment that they especially enjoy this part of the critical thinking curriculum. Some fallacies are so common that a single issue of a newspaper or news magazine is virtually guaranteed to contain examples. Other fallacies of reasoning are especially common in everyday speech and conduct.

Exercise title: “Fallacy hunting.”

Time required: \geq 15 minutes per fallacy.

Purpose: Expose students to patterns of bad thinking that are so common that over the centuries they have been given names. I recommend that instructors identify a small set of prominent fallacies to be covered in the course, e.g., equivocation, *ad hominem*, fallacious appeal to authority, hasty generalization, false dilemma, slippery slope, appeal to popularity, and argument from ignorance.

Certain formal fallacies such as conversion, affirming the consequent, and denying the antecedent are very common in ordinary speech, no doubt because of widespread misunderstanding of the conditional and its many variant forms. However, if students can simply identify the conditional grammatical form and its most common (and not equivalent!) variants, e.g., “A if B,” “A only if B,” “A is necessary for B” and “A is sufficient for B,” much will be gained.

Special critical thinking concepts needed for exercise: argument, premise, conclusion, inference strength (validity, inductive strength)

Procedure: First session should include a review of inference strength, i.e., an argument is valid if, assuming that the premises were true, the conclusion could not possibly be false; and an argument is inductively strong if, assuming that the premises were true, the conclusion is unlikely to be false. Then, define the first target fallacy and provide examples. Finally, distribute a short list of passages, some of which commit the target fallacy, and ask students to identify the passages containing the target fallacy. Students should write the premise and conclusion of each passage so that the fallacy can be more easily identified. Use short passages only to begin with.

Sample passages:

1. Each of the amendments to the Constitution covers only a very narrow issue, so the Bill of Rights (the first 10 amendments) is much too narrow to provide Americans with adequate protection of their rights.
2. Hitler was a strong supporter of abortion, so it must be wrong.
3. Elective abortion in the first trimester is the first step to wholesale murder. Today it's limited to the first three months, which is okay, but next it will be the first six months, then any time during pregnancy, and before you know it, this country will be practicing infanticide up through the first six years of life!
4. Why should I report the few hundred dollars I make mowing lawns? Most people in my church under-report their income, so it must be okay.

5. If Joan says that you can get an A in Logic without doing your homework, then you'd better believe her. After all, she was chosen as Miss Soybean for 2004 and she's also President of Eta Pumpkin Pi Sorority.
6. The reluctance to extend protection [of rape laws] to married women is attributable partly to the feelings of self-preservation on the part of married American male legislators. (Margaret T. Gordon and Stephanie Riger, *The Female Fear: The Social Cost of Rape* as quoted in Irving M. Copi and Keith Burgess-Jackson, *Informal Logic*, 3d ed.)
7. The great philosopher Aristotle himself states that a rock falls to the ground because it desires to return to earth and rest, so how can we possibly think that gravity really exists?
8. No one has ever provided any evidence that there are metamorphic rocks on extrasolar planets, so we may correctly conclude from this fact that there are none.
9. DOBERT: Can you prove that chlorination is useful in making water safe?

ALGAN: Yes, I can. Devton gets its water from the same place that we do. Three years ago, Devton had nine cases of typhoid fever. Two years ago they started to chlorinate and they had only two cases that year. That's proof enough. (Robert H. Ennis and Jason Millman, *Cornell Critical Thinking Test Level Z*)
10. There is a very strong statistical correlation between owning a car and having a job, so if you want to get a job, just buy a car.
11. God exists because the Bible tells us so, and we know that what the Bible tells us must be true because it is the revealed word of God. (from I. M. Copi, *Introduction to Logic*, 7th ed.)
12. We can safely ignore anything that Osama bin Laden has to say about the Israeli-Palestinian conflict. The guy is clearly insane, and as a moral being is down with Hitler, Stalin, and other mass murderers of the 20th century.
13. I never use aspirin or acetaminophen. These are drugs and if I started using them, before long I'd be taking methamphetamine and Quaaludes, and then I'd be hooked for good.
14. Bush's former drug-using behavior just sickens me. I feel that he lied about his service in the National Guard and I don't care what his supporters say. Bush should be impeached.
15. Food costs are beginning to soar. The price of hamburger went up 19% in one week.

16. Most people on welfare are ripping off the taxpayer. I saw a woman in Kroger's the other day who bought ten pounds of filet mignon with a Food Stamp card, and then she drove away in a Cadillac!

III. Topics for Discussion.

- Curriculum
- Assessment
- Faculty development
- Critical Thinking Resources Web Site:
<http://ourworld.compuserve.com/homepages/dclose/dcct.htm>

Conclusion.

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Selected Bibliography

Textbooks:

- Beardsley, Monroe C. 1950. *Practical Logic*. Englewood Cliffs, N.J.: Prentice-Hall, Inc. [out of print, available].
- Black, Max. 1950, 1946. *Critical Thinking*. New York: Prentice-Hall, Inc. [out of print].
- Boyd, Robert. 2003. *Critical Reasoning and Logic*. Upper Saddle River, N. J.: Prentice Hall, Inc.
- Cederblom, Jerry, and David W. Paulsen. 2000. *Critical Reasoning*. 5th ed. Belmont, CA: Wadsworth Publishing Co.
- Chaffee, John. 2003. *Thinking Critically*, 7th ed. Boston: Houghton Mifflin Co.
- S. Morris Engel. 2000. *With Good Reason: An Introduction to Informal Fallacies*. 6th ed. New York: St. Martin's Press. ISBN 0-312-15758-4. \$35. (Excellent introduction to critical thinking. Very accessible.)
- Ennis, Robert H. 1996. *Critical Thinking*. Upper Saddle River, N. J.: Prentice Hall, Inc.
- Giere, Ronald N. 1997. *Understanding Scientific Reasoning*, 4th ed. Belmont, CA: Wadsworth Publishing Co.
- Hughes, William. 2000. *Critical Thinking*, 3d ed. Ontario: Broadview Press.
- Johnson, Ralph H., and J. Anthony Blair. 1994. *Logical Self-Defense*. New York: McGraw-Hill, Inc.
- Kelley, David. 1998. *The Art of Reasoning*, 3d expanded ed. New York: W. W. Norton and Co.
- Kiersky, James H., and Nicholas J. Caste. 1995. *Thinking Critically: Techniques for Logical Reasoning*. Minneapolis-St. Paul: West Publishing Co.
- Moore, Brooke Noel, and Richard Parker. 2003. *Critical Thinking*, 7th ed. New York: McGraw-Hill, Inc.
- Nolt, John Eric. 1984. *Informal Logic: Possible Worlds and Imagination*. New York: McGraw-Hill, Inc.
- Paul, Richard. 1993. *Critical Thinking: What Every Person Needs to Survive in a Rapidly Changing World*, 3d ed. Dillon Beach, CA: Foundation for Critical Thinking. [out of print, available].
- Paul, Richard, and Linda Elder. 2001. *The Miniature Guide to Critical Thinking: Concepts and Tools*. Dillon Beach, CA: The Foundation for Critical Thinking. [Not really a textbook, but an inexpensive, useful pamphlet for students.]
- Salmon, Merrilee. 2002. *Introduction to Logic and Critical Thinking*, 4th ed. Belmont, CA: Wadsworth.

- Scriven, Michael. 1976. *Reasoning*. New York: McGraw-Hill Book Co. [out of print, available].
- Teays, Wanda. 2003. *Second Thoughts: Critical Thinking for a Diverse Society*, 2d ed. New York: McGraw-Hill, Inc.
- Thomas, Stephen N. 1996. *Practical Reasoning in Natural Language*, 4th ed. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Weston, Anthony. 2000. *A Rulebook for Arguments*, 3d ed. Indianapolis: Hackett Publishing Co. ISBN 0-87220-552-5. 87 pp. \$5.95. [I used this in COR 100. Students commented very positively on it. Inexpensive and brief, with a Strunk and White feel.]
- Wright, Larry. 1982. *Better Reasoning: Techniques for Handling Argument, Evidence, and Abstraction*. New York: Holt, Rinehart and Winston. [out of print, available].

Books and collections of papers on critical thinking:

- Bacon, Francis. [1997], 1605. *The Advancement of Learning: With a Brief Memoir of the Author*. Whitefish, MT: Kessinger Publishing Co. Available online: Krech, Hartmut, ed. 2003. <http://www1.uni-bremen.de/~kr538/baconadv.html> (16 May 2005).
- Cromwell, Lucy S., ed. 1986. *Teaching Critical Thinking in the Arts and Humanities*. Milwaukee: Alverno Productions.
- McPeck, John. 1981. *Critical Thinking and Education*. New York: St. Martin's Press.
- Norris, Stephen P., ed. 1991. *The Generalizability of Critical Thinking*. New York: The Teacher's College Press.
- Ruggiero, Vincent Ryan. 1988. *Teaching Thinking Across the Curriculum*. New York: Harper and Row. [Excellent book. Full of history, insight, and pedagogy.]
- Siegel, Harvey. 1988. *Educating Reason: Rationality, Critical Thinking and Education*. New York: Routledge.
- Talaska, Richard A. 1992. *Critical Reasoning in Contemporary Culture*. Albany: State University of New York Press. [An important collection with papers by Ennis, Scriven, McPeck, Paul, Johnson, and others.]
- Toulmin, Stephen. 2003. *The Uses of Argument*, 2d ed. Cambridge: Cambridge University Press.

Selected Journals:

Informal Logic
Inquiry: Critical Thinking Across the Disciplines
Teaching Philosophy
Argumentation

Philosophy and Rhetoric

APA Newsletter on Teaching Philosophy [some issues available online at
<http://www.apa.udel.edu/apa/publications/newsletters/>]

Critical Thinking Assessment:

Robert Ennis, co-author of the *Cornell Critical Thinking Test* and the *Ennis-Weir Critical Thinking Essay Test*, has a very thorough list of currently available critical thinking assessment tools. See Robert H. Ennis, “An Annotated List Of Critical Thinking Tests.” June 2002.
<http://faculty.ed.uiuc.edu/rhennis/TestListM9Y01.html> (16 May 2005).

NOTES