1

The Nature and Nurture of Critical Thinking

Diane F. Halpern

It was during a presentation on ways to enhance critical thinking in college classes that a jaded faculty member shot back at me, "What kind of thinking do you think I teach – noncritical thinking?" I assured this faculty member that no offense had been intended, although certainly it had been taken. In fact, often there is noncritical, or more appropriately labeled, rote memorization or lower level thinking that is taught and tested in many classrooms at all levels of education at the expense of higher order or critical thinking.

NONCRITICAL THINKING

Consider, for example, typical questions that might be found on tests given in developmental psychology classes. There is the ubiquitous question that asks students to list each stage of Piaget's theory of cognitive development, along with the age range for each stage, and an example of a cognitive task that can be accomplished at each stage. This is a basic recall question, even though there is an opportunity to provide an example, which allows for the application of the knowledge of what cognitive abilities become possible at each stage of development. The example given is almost always the same as an example that was presented in class or in the text. If this is the extent of students' knowledge, they are unlikely to be able to use Piaget's conceptualization of cognitive development in any applied setting (such as designing an age-appropriate toy or activity for a preschool) or in a novel or useful way. The information remains available in memory for repetition, but it is not likely to be used.

In a similar vein, consider what most students know about Freudian theory at the end of a course where this is one of several topics covered. Most students can define terms like *id*, *ego*, and *superego*, but these are disconnected concepts that are, at best, loosely related to other Freudian terms like *penis envy* and *projection*. For the most part, students can define these terms in a few words, see little or no connection among them, and have

the general idea that Freudian theory is something to be giggled at and rejected. Few students can see how Freudian theory is related to other theories or personality or development, or are able to recognize the parts of Freudian theory that have survived for almost a century, or know how to think about Freudian theory from the context of a different sociohistorical period, and so on. Even though I have not yet defined critical thinking, I believe most people would recognize this sort of thinking as noncritical. These are examples of memorization or recall, the ability to remember what was learned. Knowledge about a content area is critical to critical thinking; no one can think critically about any topic without the necessary background information, but the facts alone are not enough. In the language of math and logic, they are necessary but not sufficient.

FIRST, SOME EXAMPLES

Critical thinking: everyone thinks it's a good idea, and everyone agrees that we want a workforce and a citizenry that can do more of it. When college and university faculty were asked about "the basic competencies or skills that every college graduate [should] have," they listed critical thinking (and problem solving) along with communicating and interpersonal skills, and computer literacy (Diamond, 1997). If you read the classified ads for executive positions of all sorts – regardless of whether the job is in accounting, law, trade, government, education, technology, or some other area – the top job skill listed is almost always some variant of critical thinking, and if it missing, it is often because it is assumed to be essential for any job where the knowledge base and context in which it is applied are rapidly changing. But, how can someone become a more critical thinker and, more specifically, how does studying psychology help students achieve this goal?

Before answering these questions and considering theories or frameworks of critical thinking that provide a way of thinking about how to get better at thinking, let's start with a few examples of applications of critical thinking skills.

Example 1: Understanding, Shaping, and Communicating Opinions About Complex Topics

Suppose that you are elected to a high-level government office and in that position you are trying to decide whether to support legislation that would provide parents with school vouchers. (If you live in the United States and keep up with its news, you will recognize this as a contemporary issue.) You want to know what your constituents think, so you decide to conduct a poll. You ask two different assistants to each write a question that would accurately assess opinions about school vouchers. Unknown to you, one of

your assistants is in favor of vouchers and the other is opposed. Here are the two questions they submit.

1. Do you favor or oppose allowing students and parents to choose a private school to attend at public expense?
2. Do you favor or oppose allowing students and parents to choose any school, public or private, to attend using public funds?

Read these two questions carefully. Do you think that you will get approximately the same percentage of people who say that they favor vouchers in response to both questions? Which question will provide a greater percentage of "favor" responses? (Big hint: This second question should provide a clue as to the correct answer to the first question.)

In fact, in a real poll using these two questions, 41% of respondents answered that they favor school vouchers when they were asked Question 1, compared with 63% who were asked Question 2 (report from the 36th Annual Phi Beta Kappa Wirthlin Gallup Poll of Attitudes Toward Public Education; see "Gallup Poll," 2004).

Look carefully at the way seemingly slight changes in the wording, which might go unnoticed if only one version had been used, can alter the way a proportion of the public thinks about and responds to complex questions with important social ramifications. Of course parents could always choose public schools for their children, but public schools are not explicitly mentioned in Question 1. Question 2 appears to be providing a real choice, whereas there seems to be less choice in the way Question 1 is worded. Results from polls like these are often used to shape and communicate public opinions and to establish laws and policies. Sometimes, the wording is deliberately chosen in ways to sway people who may not be sure what they think and in ways that are not easy to detect. This is just one example of the way we use words to communicate information about thinking and to persuade others. Numerous other examples can be found in texts and workbooks on critical thinking (e.g., Halpern, 2003; Halpern & Riggio, 2003).

Example 2: Thinking With Numbers

Before you go on, answer these two questions:

Is the population of China greater than or less than 2 billion? _____
Now, without consulting any books or looking up the answer, make your best estimate about the population of China. _____

I can imagine that unless you have a particular expertise in Chinese population statistics (an unlikely area of specialization), you are moaning about this question, but go ahead and make your best estimate, even if you are complaining that you have no idea what the population of China is.

It is probably a safe assumption that you answered the first question as "less than," reasoning that although you did not know the population of China, 2 billion is probably too large. (It is interesting to trace how you decided it is probably too large, but that is another topic.) Suppose I had asked instead, "Is the population of China greater than or less than 40 million?" It would probably be a good guess to assume that you would have answered this question as "more than," still assuming that you have no good estimate of the population of China, but 40 million seems far too low.

These are "anchor" questions – not interesting in themselves because most people will "guesstimate" that the population of China is less than 2 billion and more than 40 million, which is still a pretty big range. What happens next is what is interesting. If you are asked the question with the "2 billion" anchor, your estimate for the population of China is likely to be much larger than if you are given the question with the "40 million" anchor. Let's see why and when this can be important. In situations like these, people use the number that is presented, even though they reject it, as an anchor or starting point for their thinking and they then adjust their thinking from there. If I wanted you to think of the population of China as huge – perhaps I wanted to convince you that the Chinese pose a grave threat, or I wanted to convince you to invest in something I plan to market in China – then I would start with some high value. I might start by saying that although the population is less than [insert some high value], it is a huge number of people and therefore you should either be afraid or invest money in my project, depending on what I want you to do.

I could influence how you think without ever giving you the exact numbers or even numbers that are even close to the actual values. Similarly, I could try to persuade you that the population of China is not as large as you might think, and therefore it does not pose a great risk, or that it would not be a good investment opportunity, or whatever it was that I was trying to persuade you about with regard to China. I might say, of course, that it is larger than [insert some value here], but not as large as most people often think, and so on. In this way, and without ever presenting meaningful numbers, one can shape a listener's appraisal of magnitude; your thinking about the relative threat or quality of an investment is manipulated without your awareness.

Now, use this information about anchoring in a totally different context to see if you can transfer this critical thinking skill. Should you suggest a starting salary when you are applying for a job? Answer this question and explain your answer before you continue reading.

If an anchor is a starting point and adjustments are made from the first number that is mentioned, then unless you have some specific information that might prove otherwise for a specific job, it seems to be to your advantage to set the anchor, as long as you do not undersell your own worth. Presumably you would set a higher value than your prospective employer, who would

want to negotiate toward the value you set (assuming she recognizes that your critical thinking abilities are worth the high salary!). Anchoring and adjusting values from that anchoring when you are thinking about numbers is a topic that is studied and taught in cognitive and social psychology classes that is useful to understand regardless of your intended future career (Epley, Keysar, Van Boven, & Gilovich, 2004; Galinsky & Mussweiler, 2001). (Just think about all of the cars you are likely to buy!)

Example 3: Applied Research Design and Analysis

An expensive exam preparation program boasts that students who take its course to prepare for the law school entrance exam and who attend classes regularly score higher on the law school entrance exam than do students from the same colleges who do not take this special coursework. Can we conclude that the exam preparation program is an effective way to boost exam scores on the law school application exam?

Although it is tempting to conclude that this program does exactly what its promoters claim that it does, it is likely that students who take the program and attend regularly differ in many ways from those who do not. Those who can afford an expensive exam preparation program probably have many advantages that are associated with higher family income levels – better schools, more educational experiences out of school, larger vocabulary used at home, and so on. These students are, on average, likely to be more motivated, if they attended class regularly, than those who dropped out or attended only sporadically. It would be necessary to sample students and randomly assign them to attend or not attend the special preparation program and then compare scores on these two groups to determine if the program was an effective preparation for the law school examination. It is possible that less affluent but highly motivated students could prepare on their own or with friends by using other materials with the same positive results. Much more extended and elaborate examples of research designs as critical thinking are presented throughout this book.

These three examples are all everyday applications of skills that would be learned and used in psychology courses, although they are applicable in a wide variety of contexts that do not "look like" psychology. They are needed for success in and out of school.

WHAT IS CRITICAL THINKING?

Although many psychologists and others have proposed definitions for the term *critical thinking*, these definitions tend to be similar in content in that they include skills and abilities and the disposition to use those skills and abilities in a careful and thoughtful manner. For example, Ennis proposed a two-part model of critical thinking with the disposition to care about

"getting it right" and "care about presenting positions honestly and clearly" (Ennis, 2001).

In a recent review of the critical thinking literature, Fischer and Spiker (2000) found that most definitions for the term *critical thinking* include reasoning or logic, judgment, metacognition, reflection, questioning, and mental processes. Jones and his colleagues (Jones, Dougherty, Fantaske, & Hoffman, 1997; Jones, 1995) obtained consensus from among 500 policy makers, employers, and educators, who agreed that *critical thinking* is a broad term that describes reasoning in an open-ended manner and with an unlimited number of solutions. It involves constructing a situation and supporting the reasoning that went into a conclusion. Paul, Willson, and Binker (1993) have a similar conceptualization of critical thinking as self-directed and "fair-minded," with clarity about the nature of the problem, the way generalizations are made, the evidence, and conclusions.

Here is a simple definition that captures the main concepts: *Critical thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed – the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task.* Critical thinking is more than merely thinking about your own thinking or making judgments and solving problems – it is using skills and strategies that will make "desirable outcomes" more likely.

There are many different taxonomies of critical thinking skills, and although they differ in the way skills are grouped, and sometimes in the vocabulary used to describe the skills or groups of skills, the differences among the various authors in this field are not important in this context. Critical thinking skills are often referred to as "higher order cognitive skills" to differentiate them from simpler (i.e., lower order) thinking skills. Higher order skills are relatively complex; require judgment, analysis, and synthesis; and are not applied in a rote or mechanical manner. Higher order thinking is thinking that is reflective, sensitive to the context, and self-monitored. Computational arithmetic, for example, is not a higher order skill, even though it is an important skill, because it involves the rote application of well-learned rules with little concern for context or other variables that would affect the outcome. By contrast, deciding which of two information sources is more credible is a higher order cognitive skill because it is a judgment task in which the variables that affect credibility are multidimensional and change with the context. In real life, critical thinking skills are needed whenever we grapple with complex issues and messy, ill-defined problems.

A list of generic skills that can be important in many situations would include these: recognizing that a problem exists; developing an orderly, planful approach so that tasks are prioritized and problems are recognized as differing with regard to how serious and urgent they are; generating a reasoned method for selecting among several possible courses of action;

relating new knowledge to information that was previously learned; using numerical information, including the ability to think probabilistically and express thoughts numerically; understanding basic research principles; and presenting a coherent and persuasive argument about a controversial, contemporary topic. These are all examples that are useful across a wide variety of contexts and that can easily be understood by a broad range of audiences. In my own work (Halpern, 2003), I have suggested 5 to 10 groupings of skills, depending on the context, because I believe that various groupings are possible and groups can contain different numbers of skills, again depending on the reason for the grouping.

A 10-category taxonomy with some examples of the critical thinking skills that apply in each category is shown in Table 1.1.

An alternative way of categorizing thinking skills was proposed by Sternberg (1996) in a tripartite model of the thinking skills that collectively make up "successful intelligence." Most school settings teach and test for the first skill set: analytical thinking skills, which includes analyzing, critiquing, judging, evaluating, comparing and contrasting, and assessing. These thinking skills are valued in school settings (i.e., book learning), and people who are good at these sorts of thinking tasks also tend to score high on traditional measures of intelligence, which are heavily weighted with analytical thinking tasks. The other two components of successful intelligence are creative thinking skills, which include creating, discovering, inventing, imagining, supposing, and hypothesizing; and practical thinking skills, which include applying, using, and practicing the other thinking skills. According to Sternberg, creative and practical thinking skills are largely independent of the sort of thinking skills that are assessed in traditional measures of intelligence, which are overweighted with the thinking skills that are needed for success in school. This conceptualization is a skills-based approach, with three broad groupings of skills.

In an empirical test of his theory, Sternberg and his coauthors (Sternberg, Torff, & Grigorenko, 1998) found that students tend to have a preference for one of these three types of thinking skills; when they were taught predominantly with their preferred thinking skill, they learned better than when the primary teaching method did not match their preferred learning skill. In a later extension of his theory to the topic of wisdom, Sternberg (2003) added a value component that emphasizes the importance in wisdom of using successful intelligence as well as creativity and knowledge for the goal of attaining common good.

CAN CRITICAL THINKING BE LEARNED?

Is the ability to think critically an inherited or natural ability that is relatively immune to the effects of learning, or is it an ability that can be developed or enhanced with appropriate instruction? This is a familiar question for psychologists – it is a variant of the age-old question of nature versus nurture

TABLE 1.1. *A Short Taxonomy of Critical Thinking Skills*

Grouping	Skills
1. Critical Thinking Framework: A General Set of Questions to Guide Thinking	What is the goal? Which thinking skill(s) will help you reach your goal? Have you reached your goal?
2. Memory: The Acquisition, Retention and Retrieval of Knowledge	How to make abstract information meaningful. How you can use overlearning, cognitive interviewing techniques, and memory triggers to recall and organize information. How to develop an awareness of biases in memory.
3. The Relationship Between Thought and Language	How to understand and use questioning and listening strategies. How to recognize and defend against the use of inappropriate, emotional language. How to choose and use graphic organizers.
4. Reasoning: Drawing Deductively Valid Conclusions	How to discriminate between deductive and inductive reasoning. How to understand the differences between truth and validity. How to properly use quantifiers in reasoning.
5. Analyzing Arguments	How to diagram the structure of an argument. How to examine the credibility of an information source. How to judge your own arguments.
6. Thinking as Hypothesis Testing	How to understand the limits of correlational reasoning. How to isolate and control variables in order to make strong causal claims. How to know when causal claims can and cannot be made.
7. Likelihood and Uncertainty: Understanding Probabilities	How to use probability judgments to improve decision making. How to compute expected values in situations with known probabilities. How to avoid overconfidence in uncertain situations.
8. Decision Making	How to reframe decisions to consider alternatives. How to prepare a decision-making worksheet. How to understand the distinction between the quality of a decision and its outcome.

Grouping	Skills
9. Development of Problem-Solving Skills	How to plan and monitor a strategy for finding a solution. How to use graphs, diagrams, hierarchical trees, matrices, and models as solution aids. How to select appropriate problem-solving strategies.
10. Creative Thinking	How to visualize the problem. How to brainstorm productively and create alternatives. How to gather additional information.

that underlies virtually every discussion of intelligence. Critical thinking is similar to intelligence in many ways, so it is subject to many of the same debates. Fortunately, the term *critical thinking* carries less "baggage" than the word *intelligence*, so the debates are a little less acrimonious. For those who are still arguing this question, one way to think about the response is that there is no reason why critical thinking could *not* be improved with instruction. Writing classes are taught in the belief that, on average, across a variety of contexts and disciplines, writing will improve when students learn the skills taught in these classes. Similarly, math classes are taught in the belief that students will be better at math wherever they need to perform math – that is, across settings and domains of knowledge – when they learn basic transcontextual math skills. Sometimes the skills that are taught in these classes transfer to other contexts and sometimes they do not, but individual failures do not mean that success is not possible. There are many examples of improvement in critical thinking as a result of appropriate instruction.

Critical thinking instruction is predicated on two assumptions: (a) that there are clearly identifiable and definable thinking skills that students can be taught to recognize and apply appropriately, and (b) if the skills are recognized and applied, the students will be more effective thinkers. There is ample evidence that this is true, but better thinking is not a necessary outcome of traditional, discipline-based instruction. However, when thinking skills are explicitly taught for transfer, using multiple examples from several disciplines, students can learn to improve how they think in ways that transfer across academic domains. Rubinstein's highly successful course in problem solving (Rubinstein & Firstenberg, 1987) and Woods' use of deliberate planning and monitoring (Wood, 1987) are among the earlier models of successful instruction in critical thinking that eventually swayed even the staunchest critics.

After an exhaustive review of the literature, the Thinking Skills Review Group (2005, p. 6) concluded that "the majority of studies report positive impact on pupils' attainment across a range of noncurriculum measures"

(such as reasoning or problem solving). No studies reported a negative impact on such measures. This conclusion was based on a review of 23 "highly relevant studies": 6,500 chapters, articles, and papers were initially identified as relevant, from which 800 were identified as potentially having sufficient information for a review; 191 of these actually had all of the necessary information, and finally 23 allowed in-depth analyses.

Additional strong support for beneficial outcomes from critical thinking instruction comes from a collection of studies by Nisbett (1993) and his colleagues. For example, in one study, Nisbett and his coauthors phoned students at their home after the coursework was completed, under the guise of conducting a survey. They found that students spontaneously applied the thinking skills that they had been taught in school when they encountered novel problems, even when the school-related context cues were absent (Fong, Krantz, & Nisbett, 1986). In a different study, inductive reasoning tasks were taught to college students by using realistic scenarios from many different domains. Students were able to use these skills on a later test. The authors concluded that critical thinking is "a skill" and that "it is transferable" (Jepson, Krantz, & Nisbett, 1993, p. 82). Nisbett's edited book contains 16 chapters that show that rules of logic, statistics, causal deduction, and cost–benefit analysis can be taught in ways that will generalize to a variety of settings. Similar conclusions were found in a recent study conducted at Universidad de Salamanca in Spain, which is available online with learning materials in Spanish (Nieto & Saiz, 2006). There is a solid body of research to support the strong conclusion that specific instruction in thinking skills with diverse types of contexts (to encourage transfer across domains of knowledge) will enhance critical thinking skills.

A PEDAGOGY FOR CRITICAL THINKING

In addition to (a) explicitly teaching the skills of critical thinking, critical thinking instruction needs to (b) develop the disposition for effortful thinking and learning, (c) direct learning activities in ways that increase the probability of transcontextual transfer, and (d) make metacognitive monitoring explicit and overt.

Critical thinking is effortful; it requires a concern for accuracy and the willingness to persist at difficult tasks and suppress immediate and easy responses. It requires an openness to new ideas, which some people find to be the most difficult component. Many people find it easier to reject any new idea with an automatic response like "If it ain't broke don't fix it," instead of considering whether a new approach to an old problem or a new look would change how we think about old problems. Similarly, it often seems easier to stay away from learning or trying anything new where there is the chance of failure. The familiar is comfortable and safe, but not always the best response.