

From Derek Bok, Our Underachieving Colleges: A Candid Look At How Much Students Learn and Why They Should Be Learning More, Princeton, New Jersey: Princeton University Press, 2006.

Chapter 5, Learning to Think

(Note: all material below is directly quoted from the text of the chapter. The first portion of this chapter deals with critical thinking, the second with quantitative reasoning.)

P. 109-110. With all the controversy over the college curriculum, it is impressive to find faculty members agreeing almost unanimously that teaching students to think critically is the principal aim of undergraduate education. The reasons for the consensus are quite clear. Merely accumulating information is of little value to students. Facts are soon forgotten, and the sheer volume of information has grown to the point that it is impossible to cover all the important material or even to agree on what is most essential. Concepts and theories have little value unless one can apply them to new situations. The ability to think critically—to ask pertinent questions, recognize and define problems, identify arguments on all sides of an issue, search for and use relevant data, and arrive in the end at carefully reasoned judgments—is the indispensable means of making effective use of information and knowledge, whether for practical or purely speculative purposes. What is remarkable, then, is not that professors place so high a value on critical thinking; the wonder, as we will soon discover, is that they do not do more to act on their belief. Ironically, the fact that college faculties rarely stop to consider what a full-blown commitment to critical thinking would entail may help to explain why they have been so quick to agree on its importance to the undergraduate program.

Teaching Critical Thinking

Of course, colleges do provide many ways for students to improve their critical thinking. Lectures and readings offer countless examples of how well-trained minds address difficult problems. Seminars give opportunities for participants to express their own thoughts on challenging questions and hear the reactions of professors and peers. Term papers and homework assignments invite students to think through problems carefully and have their work critiqued by knowledgeable instructors. Outside the classroom, undergraduates argue among themselves about problems raised in their readings, questions posed by their professors, and a host of other issues. Working on campus newspapers and literary magazines, on dormitory councils and debating teams, in political clubs and student senates, they are constantly involved in discussions that lead them to think for themselves and expose their thoughts to the criticism of others. In these encounters, the varied backgrounds, values, and perspectives represented in the typical student body challenge participants to examine their premises, confront novel arguments, and test their reasoning against new information and unexpected ideas.

P. 110-111. Not surprisingly, researchers studying the effects of college find that these activities yield results; by all accounts, most undergraduates improve their critical thinking skills significantly by the time they graduate.

P. 111-112. A few investigators have found that the *kinds* of reasoning skills that students develop can be influenced by their choice of undergraduate major. According to these researchers, probabilistic reasoning (making judgments using estimates of risk or the likelihood of particular results occurring) improves substantially among students

concentrating in the social sciences—where statistics are commonly taught and applied—but not among students in the humanities or natural sciences. Conditional reasoning (if x exists, then y follows) increases markedly among students majoring in the humanities and natural sciences but not among social science concentrators.

P. 112. Cognitive skills are not all there is to thinking effectively. Students must be sufficiently motivated to work hard to solve the problems they encounter in class, since added effort has a significant effect on progress in critical thinking. This obvious proposition exposes a deeper problem confronting colleges across the United States. There is evidence that many undergraduates are not sufficiently engaged to work conscientiously at their studies and that their numbers are growing.

P. 113. The ability of students to think critically and solve problems is also affected by the epistemic assumptions they make in addressing the loosely structured problems, so common in real life, that have no demonstrably correct answers. According to investigators, young people in early stages of development tend to think that all questions have definite answers. The way to find the answer is to ask the experts or consult some other authoritative source. As students advance to intermediate levels, they come to realize that many unstructured problems do not have certain solutions even for experts—only subjective opinions that reflect the respondent's values, experience, and beliefs. Undergraduates at these stages are naïve realists; they think that different people have different views and that there is no valid basis for judging the opinions of others. At the highest levels of development, students continue to recognize that many questions cannot be answered with certainty, at least for the time being. Nevertheless, they realize that people must still make judgments, that those judgments can be evaluated, and that some are more persuasive and better reasoned than others based on available evidence. For students who have advanced to this level, even well-reasoned conclusions are best thought of as provisional, to be discarded if necessary when powerful contrary facts and arguments come to light.

P. 113-114. Researchers have found links between epistemic stages and proficiency in critical thinking. Students with weak critical thinking skills are almost always at an early epistemic stage and are invariably poor in arriving at thoughtful solutions to messy, loosely structured problems. As students progress to higher epistemic stages, their critical thinking tends to improve. Students at advanced stages who also have good critical thinking skills are almost always proficient in arriving at well-reasoned judgments about such problems.

P. 114. Using these epistemic stages, investigators have found that many entering freshmen arrive at college in a condition of "ignorant certainty," believing that most or all problems have definite answers, that ignorance may keep them from knowing the answer, but that the truth can be found by consulting the right expert. During the college years, most students do make significant progress (from "ignorant certainty" to "intelligent confusion"), but large majorities remain in a naïve relativist state, persuaded that many problems have no single correct answer and that none of the possible answers is necessarily better than the others. Only a small minority of seniors emerge convinced that ill-structured problems are susceptible to reasoned arguments based on evidence and that some answers are sounder than others.

P. 115. Still other researchers have found that students are often unable to think effectively about material in a course or apply what they have learned to new problems

and new situations because they have not truly understood the underlying concepts on which the course was based. Some cannot grasp the concepts because they enter the course with faulty preconceptions that clash with the principles they are asked to learn. Others simply do not understand the basic principles. Many professors skip over these concepts too quickly, because they are so familiar with the ideas that they cannot appreciate how confusing the material can be to students or how often undergraduates come to the course with misunderstandings that actually make it harder for them to comprehend. In these circumstances, undergraduates use rote learning to pass the course, without truly understanding the basic principles involved. So long as professors assign questions similar to those discussed in class students can rely on their memory to find the right answers, and their instructors never realize how little understanding they possess.

P. 116-117. Cognitive psychologists have an explanation for why colleges do not have greater success in improving the reasoning ability of undergraduates. Influenced by the work of Piaget, they affirm what many professional school faculty have long believed about how best to develop critical thinking. In their view, passive lecturing and drill can help students memorize rules and concepts and apply them to a limited range of problems similar to those covered in class, but they do little to equip undergraduates to apply their knowledge to new problems. Merely inviting students to ask questions or allowing them to carry on a formless discussion among themselves is not much better. Instead, instructors need to create a process of active learning by posing problems, challenging student answers, and encouraging members of the class to apply the information and concepts in assigned readings to a variety of new situations.

P. 118. Active learning does not necessarily require a Socratic discussion led by the instructor. Many investigators have found that critical thinking and learning in general can be enhanced by giving students problems and having them teach each other by working together in groups. Simply assigning tasks to groups, however, is not sufficient. For optimum results, participating students need to recognize that each depends on the others for a favorable result; collaboration must be face-to-face; each member of the group must be held accountable in some fashion (to avoid free riders); and members should periodically discuss how each has contributed to the final product and how each could help to make the group even more effective. Where these conditions exist, the great majority of studies show that the participating students make much greater gains (approximating half a standard deviation) over those achieved by classmates studying individually or competing with one another for grades or other prizes. Group learning has other benefits as well. It teaches students how to collaborate effectively. Where groups are mixed by race, it can reduce prejudice. It may even help integrate students into academic life and reduce attrition from college.

Teachers who focus attention on the process of problem-solving can also help their students. Researchers find that teaching students different strategies for solving problems can improve thinking. More generally, encouraging students to reflect on their methods of reasoning and to try different approaches when initial efforts fail can significantly enhance performance.

P. 118-119. Finally, in addition to adapting their teaching to promote active learning, instructors need to give students frequent opportunities to test their cognitive skills and receive prompt feedback on the results. Without periodic evaluation, undergraduates cannot know how well they are doing, what errors they are making, and what they need

to do to improve. They can receive the necessary feedback in various ways—through periodic exams, student papers, or short quizzes in class. The essential point is to give tests or assign papers that call for the kinds of careful reasoning encouraged in class and then give a careful enough evaluation of the results that students can understand what they did wrong and where they still need to improve.

P. 119-120. To sum up, instructors who do best at teaching critical thinking tend to follow a number of guiding principles. They begin not by deciding what material they ought to cover but by concentrating on what it is they want their students to learn—what reasoning skills they ought to master and what knowledge they need to absorb to deal with problems posed in the course. They devote much thought to how to awaken their students' curiosity and make them want to learn, not just to get a grade but out of intrinsic interest in the subject. They search for common misconceptions students bring to the course that interfere with their thinking and then look for ways to expose and ultimately overcome these mistaken beliefs. They encourage their students to think for themselves by challenging them with interesting questions and using class discussions, collaborative projects, and other forms of active learning to develop habits of critical thinking and respect for the power of careful reasoning and analysis. They evaluate their students through papers and tests closely tied to the objectives of the course in order to learn how well members of the class are progressing and give timely feedback to help students monitor their own progress and understand how they can improve their powers of reasoning and analysis. Finally, they try to convey high expectations for the class while giving students confidence they can succeed.

P. 120. Despite their overwhelming support for critical thinking as the primary goal of undergraduate education, most professors do not teach in the manner just described. Rather than discussing problems in class, or using group work to promote active learning, they spend almost the entire hour lecturing to a passive student audience.

P. 120. There is some indication that more professors today are turning away from lectures as the sole or primary means of teaching their classes. Even so, recent evidence suggests that "lecturing is still by far the modal instructional approach most often used" and that professors, on average, lecture more than two-thirds of the time"...Even professors who allow student participation often do little more than invite members of the class to raise questions about the lecture or to repeat information contained in the assigned readings.

P. 120-121. Methods of evaluating students are likewise open to criticism. It is well established that undergraduates study with an eye toward the kinds of questions they expect to see on their exams. As a result, instructors need to reinforce the aims of their courses by taking care to construct exams that call for the very kinds of thinking that they most want to encourage. Using multiple-choice or short-answer questions, however...all but guarantees that students will concentrate on rote learning rather than active reasoning. Added damage is done by giving students little or no timely feedback on their papers and tests or by relying almost entirely on a single final exam. Such grading practices have little educational value but merely rank students for the benefit of employers and graduate schools.

P. 121. Despite these commonsense observations, most college examinations call for short answers or multiple-choice responses and test recall of information rather than analytical skills.

P. 122. It is curious that faculty members rely so heavily on methods of teaching and assessment that seem ill suited for the goal they claim to value above all others. Why, for example, do so many college instructors continue to lecture long after most professional schools have drastically curtailed such methods in favor of more problem-based discussion?

P. 123. Teachers who feel they must lecture to cover the necessary ground forget how little students retain of what they hear....One...study reports that students recall only 42 percent of the information in a lecture by the time it ends and only 20 percent one week later. After a month or a year has passed, the residue is presumably even smaller.

P. 123-124. Other studies have found that students retain material longer if they have acquired it through their own mental effort. Hence students who have to use the concepts and information they acquire to solve problems tend to remember them longer than if they merely listen to lectures. Basic critical thinking skills are especially likely to remain when they are taught, because they are learned through repeated practice and continually used and reused in everyday life after students graduate.

P. 125. Undergraduates too are often allies of the faculty in resisting active learning methods. Once they have grown used to problem-based discussions, they tend to value them more than lectures and are more motivated to prepare and participate in class. Initially, however, they will often prefer lecturing. Lectures demand little of them except sitting still. No preparation for class is necessary. For students at primitive states of epistemic development, it may be frustrating to have professors "waste time" encouraging debate instead of simply giving the class the correct answers.