Chapter 9

How Cognitive Psychology Can Enhance Your Students' Learning

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This year, more than 600,000 full-time college faculty members in the United States will teach more than 17 million students ("The Nation," 2007). Given the enormity of this enterprise, wouldn't you expect to find hundreds of articles and books about how to apply cognitive psychology, to help our students learn more effectively? In 2002, I wrote a chapter entitled "Cognitive Psychology and College-Level Pedagogy: Two Siblings Who Rarely Communicate" (Matlin, 2002). Four years later, these two siblings still do not have frequent conversations.

Here's one index of this communication problem. Applied Cognitive Psychology is a respected journal that should focus on how college professors can enhance their students' learning. Between January 1996 and July 2007, I located 39 articles published on improving students' classroom learning. That's about three or four articles each year. During that same period, how many articles do you think this journal published on another application of cognitive psychology, specifically, eyewitness testimony? Make an educated guess, and then check the answer at the end of this chapter. Clearly, you can make an important contribution to psychology by conducting applied cognitive-psychology research about classroom learning!

In this chapter, I will discuss seven basic suggestions about improving students' learning. In general, I'll emphasize memory improvement, but some suggestions focus on problem solving.

1. Divided-attention situations typically reduce acquisition and retention

Several decades of cognitive psychology research demonstrate that people cannot effectively pay attention to two simultaneous messages (Ward, 2004). However, are you unintentionally creating a divided-attention dilemma for your students? For instance, do you distribute a handout to students, and then lecture while they read the handout?

In my course in Psychology of Women, I used to begin the topic of women and work by distributing a handout, while describing our topics for that day. This handout was a short essay written by a former student of mine who had emigrated from China. When she arrived in New York City as a teenager, she actually worked in an illegal sweatshop. No surprise, but my students chose to read her essay, rather than to hear my overview of the day's topics. I now avoid a divided-attention situation by handing this essay to them at the end of class.

The divided-attention situation also arises when professors use PowerPoint in a class while simultaneously presenting other information in a lecture. Students often complain that they cannot take notes on the PowerPoint slide they are seeing while simultaneously recording the words they are hearing from their professor. Yes, some professors use

PowerPoint effectively. However, to paraphrase Charles Brewer, PowerPoint sometimes has a great deal of power, but not much point.

2. Students usually learn more effectively with distributed learning rather than massed learning

Think about the concepts that you really want your students to recall, say, 10 years from now. Then figure out how to emphasize these concepts several times throughout your course rather than only once. We all know that distributed learning is more effective than massed learning (Koriat & Helstrup, 2007). However, we need to remind ourselves to apply it in our own classrooms. Furthermore, students' mastery of a concept improves if they answer a question about it on an exam, even if they actually receive no feedback (Roediger & Karpicke, 2006).

3. Repeated presentations in a variety of settings typically encourage transfer of training

This principle applies not just to memory, but also to problem solving. For this principle, we need to focus on the overarching concepts that we want our students to master by the time they graduate from college. For example, I want my students to understand several basic research-methods issues, such as confounding variables and the nature of statistical interactions. Students may complete several courses in research methods, but they frequently compartmentalize their knowledge. When they are sitting in their cognitive psychology class, they often fail to apply the concepts they learned last semester.

To encourage students to apply these important concepts in a new setting, I give them a brief, ungraded quiz on each topic. According to these quizzes, for instance, many students believe that the term "confounding variable" means "anything that is wrong with your study."

Suppose that we do manage to encourage our students to think about research methods issues in several different courses, such as social psychology, personality psychology, developmental psychology, and cognitive psychology. Then they should be able to apply this kind of critical thinking when they read the newspaper or when they try to solve a problem in their professional life. In summary, we need to provide opportunities to practice, so that our students can transfer their knowledge and their problem solving skills to new settings.

4. Students often learn more effectively if they must generate information

For example, suppose that my students are looking at a complex graph showing the results of a study. I want them to look at a graph and be able to describe the various conclusions. So I pass out a copy of a graph to each student, perhaps of a 2 x 3 design. I instruct them, "Write down every conclusion that you can draw, based on the information shown in this graph." When I ask for their observations, the class may generate four or five different statements. They seem to be impressed that everyone is looking at the same graph, and yet they emphasize several different comparisons.

It's also helpful to think about the end point that we want our students to reach. I want my students, after they graduate, to look at a graph in a newspaper and be able to verbally describe the comparisons: "O.K., it looks like this main effect is significant, but I think this interaction would also be significant." (Notice that this skill is not simply memory, but problem solving.)

5. Deep levels of processing generally enhance learning

The research shows that people remember more effectively if they are encouraged to apply course material to themselves, their friends, and real-life settings (Roediger, Gallo, & Geraci, 2002). Now, I'm not sure how professors of organic chemistry could apply this principle to their teaching. However, in psychology, it's easy to ask students to think of examples from their own experiences. For instance, I begin my class in cognitive psychology by providing a standard definition of "cognitive psychology." Then I ask them to write down examples of cognitive task that they performed since they woke up that morning. As students volunteer ideas, I ask them to listen to the variety of everyday tasks and picture themselves performing each one. An additional benefit is their recognition that cognitive psychology does not need to be an esoteric course.

6. Students are typically overconfident about their mastery of a topic

Stephen Chew (2008) discussed the problem of overconfidence in his chapter which appears earlier in this volume. The research on college students' metacomprehension shows that they usually read some pages of text, and they think they understand the material perfectly. In reality, however, their accuracy is relatively low (Maki et al., 2005). Furthermore, students tend to overestimate their overall score on an examination (Koriat & Bjork, 2006). They may have a general feeling of familiarity for a given topic; however, they do not remember the precise details. I emphasize this issue several times in each class I teach, beginning on the first day of class.

This overconfidence is not a major issue for my class in cognitive psychology; students know that the course is challenging. However, each semester, I also teach psychology of women and child development. In psychology of women, for example, some students read an entire chapter on gender comparisons in academic ability, and they fail to appreciate the subtleties of the research. They may conclude, for instance, "Men are better at math." However, I want them to learn a more sophisticated concept, "On a few math tests with some groups, the average score for men is higher than the average score for women, but there is a huge overlap in the two frequency distributions. Also, for most math tests, the gender differences are minimal." (I call this oversimplification problem the "Larry Summers Effect," in honor of the former president of Harvard University.)

7. Students usually underestimate how long it will take them to complete a project

This final principle is related to students' overconfidence in memory, but it focuses more on problem solving and decision-making. According to the planning fallacy (Buehler, Griffin, & Ross, 2002), people typically underestimate the amount of time required to complete a project, and they estimate that the mission will be easy to accomplish.

We can reduce the impact of the planning fallacy by helping our students visualize each step they must complete, as well as possible roadblocks. For instance, I require a literature review paper for my course in cognitive psychology. For many years, students invariably told me that it took much longer than anticipated to complete their paper.

A few years ago, I began asking my class to write some advice about this paper that would be helpful to next semester's students in cognitive psychology. Then I record the most vivid pointers, and I hand out this advice early in the next semester. If I tell students to start their papers early, they will yawn. However, they treat the warnings

more seriously if they read the lurid details about the potential roadblocks faced by students like themselves. The students also provide cogent advice about numerous other aspects of writing literature reviews, but here is one student's quotation that addresses the planning fallacy: "Start your paper early, whether it's something as small as getting your research articles or doing an outline. If you have a week that is not busy, do some work on it instead of simply relaxing. Even if it's just a little bit of work, it all helps in the end when you are rushing around trying to complete it, and you will be that much farther ahead."

I'd like to end by urging you to consider the issue of how we can apply the research on cognitive psychology in our own classrooms. I'll also encourage you to conduct formal research on this important real-life topic. I'm hopeful that we can discover many ways to encourage these two siblings, cognitive psychology and college-level pedagogy, to develop stronger bonds with each other and engage in many productive collaborations.

Notes

Between January 1996 and July 2007, Applied Cognitive Psychology published 256 articles on eyewitness testimony, compared to 39 articles on improving students' classroom learning.

This chapter is based on a presentation titled "How cognitive psychology can enhance your students' learning." The presentation was part of an APA symposium in 2006, "Pragmatic Pedagogy: Using cognitive science to optimize learning." Regan Gurung organized the symposium.

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