CHAPTER 1

How Does Students' Prior Knowledge Affect Their Learning?

But They Said They Knew This!

I recently taught Research Methods in Decision Sciences for the first time. On the first day of class, I asked my students what kinds of statistical tests they had learned in the introductory statistics course that is a prerequisite for my course. They generated a fairly standard list that included T-tests, chi-square, and ANOVA. Given what they told me, I was pretty confident that my first assignment was pitched at the appropriate level; it simply required that students take a data set that I provided, select and apply the appropriate statistical test from those they had already learned, analyze the data, and interpret the results. It seemed pretty basic, but I was shocked at what they handed in. Some students chose a completely inappropriate test while others chose the right test but did not have the foggiest idea how to apply it. Still others could not interpret the results. What I can't figure out is why they told me they knew this stuff when it's clear from their work that most of them don't have a clue.

Professor Soo Yon Won

Why Is This So Hard for Them to Understand?

Every year in my introductory psychology class I teach my students about classic learning theory, particularly the concepts of positive and negative reinforcement. I know that these can be tough concepts for students to grasp, so I spell out very clearly that *reinforcement* always refers to increasing a behavior and *punishment* always refers to decreasing a behavior. I also emphasize that, contrary to what they might assume, *negative reinforcement* does not mean punishment; it means removing something aversive to increase a desired behavior. I also provide a number of concrete examples to illustrate what I mean. But it seems that no matter how much I explain the concept, students continue to think of negative reinforcement as punishment. In fact, when I asked about negative reinforcement on a recent exam, almost 60 percent of the class got it wrong. Why is this so hard for students to understand?

Professor Anatole Dione

WHAT IS GOING ON IN THESE STORIES?

The instructors in these stories seem to be doing all the right things. Professor Won takes the time to gauge students' knowledge of statistical tests so that she can pitch her own instruction at the appropriate level. Professor Dione carefully explains a difficult concept, provides concrete examples, and even gives an explicit warning about a common misconception. Yet neither instructor's strategy is having the desired effect on students' learning and performance. To understand why, it is helpful to consider the effect of students' prior knowledge on new learning.

Professor Won assumes that students have learned and retained basic statistical skills in their prerequisite course, an

assumption that is confirmed by the students' self-report. In actuality, although students have some knowledge—they are able to identify and describe a variety of statistical tests—it may not be sufficient for Professor Won's assignment, which requires them to determine when particular tests are appropriate, apply the right test for the problem, and then interpret the results. Here Professor Won's predicament stems from a mismatch between the knowledge students have and the knowledge their instructor expects and needs them to have to function effectively in her course.

In Professor Dione's case it is not what students do *not* know that hurts them but rather what they *do* know. His students, like many of us, have come to associate positive with "good" and negative with "bad," an association that is appropriate in many contexts, but not in this one. When students are introduced to the concept of negative reinforcement in relation to classic learning theory, their prior understanding of "negative" may interfere with their ability to absorb the technical definition. Instead of grasping that the "negative" in negative reinforcement involves removing something to get a positive change (an example would be a mother who promises to quit nagging if her son will clean his room), students interpret the word "negative" to imply a negative response, or punishment. In other words, their prior knowledge triggers an inappropriate association that ultimately intrudes on and distorts the incoming knowledge.

WHAT PRINCIPLE OF LEARNING IS AT WORK HERE?

As we teach, we often try to enhance our students' understanding of the course content by connecting it to their knowledge and experiences from earlier in the same course, from previous courses, or from everyday life. But sometimes—like Professor Won—we