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[Introduction to] College Teaching: Practical Insights From the Science of Teaching and Learning

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COLLEGE

TEACHING

Practical Insights From the Science
of Teaching and Learning

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Donelson R. Forsyth

Introduction

n early fall, the temperatures of the Earth's northern hemisphere drop, the Monarch butterflies of North America begin their migration to Angangueo, Mexico, and millions of college students stream back to campus to extend their understanding of the world. These students are not novices just beginning their studies but seasoned learners who have spent years in the classroom. They are led in their quest by professors who have achieved an extraordinary degree of mastery over their chosen field. These professors know what students most need to learn, and they have planned a series of activities and experiences—discussions, laboratory exercises, lectures, readings, tests, recitations, reviews, and so on—all designed to facilitate their students' learning. How complicated can that be?

Very complicated, it turns out. Teaching is an intentional intervention designed to result in a cognitive, affective, or behavioral change in another person: a student. It requires a rich understanding of the fundamentals of one's field, skill in organizing and communicating complex information, and the ability to accurately appraise students' progress. Good

teaching, however, requires even more: a detailed understanding of the type of change desired, insight into the psychological and interpersonal processes that influence the teaching–learning process, command of a range of methods to help students reach their educational goals, discernment in determining when teaching is or is not successful, and a willingness to modify the intervention to improve its effectiveness.

Learning, too, is complicated. Our capacity to process information makes humans the envy of all the other primates (were they capable of envy), but learning requires substantial mental effort, energy, and self-regulation. College learning is also an interpersonal process, for students' level of motivation and willingness to devote time to their studies ebbs and flows in a pulse determined as much by their social networks as by their professors' academic demands. College students are capable learners who can grasp complex topics in the arts, science, mathematics, and business, but their busy lives can cause them to pursue activities that most interest them—and those activities may not be academic ones. In most colleges and universities the professor is not the only one doing the teaching.

Fortunately, the complexities of teaching and learning do not render these processes impenetrable. Professors know that their students' final grades result from the intermingling of many causes: the student's educational experiences, personality and values, parental and peer influences, the priorities and resources of the institution, the professor's skill as a teacher. But this complex assortment of causes, correlates, and outcomes can be tamed through systematic study and thoughtful analysis.

Many are the methods that can be used to unravel the processes that sustain, promote, or impede college-level learning outcomes, but the approach I take in this book draws primarily on theoretical and empirical studies of the psychological bases of teaching and learning. Psychologists have been studying teaching and learning—and the ways to enhance those processes—for as long as the social sciences have been around. That work is ongoing, but even now it offers a means of organizing the diverse and varied factors that determine how students learn and, as a consequence, how professors should teach. This book reviews that theory and research, for it assumes that once you understand a process you can then go about improving that process.

The Science of Teaching and Learning

Researchers in psychology and related disciplines study maze-navigating rats, depressed adolescents, disenchanted factory workers, forgetful Alzheimer's patients, and the minds of musical geniuses. They also

study students and their teachers. The study of teaching and learning has been a core concern for more than 100 years, dating back to such distinguished educators and researchers as William James (1899), John Dewey (1910), G. Stanley Hall (1911), and Edward L. Thorndike (1913). Their faith in psychology as a source of principles and practices was expressed, unreservedly, by Thorndike back in 1910 in the first issue of the *Journal of Educational Psychology* when he wrote the following:

> Psychology contributes to a better understanding of the aims of education by defining them, making them clearer; by limiting them, showing us what can be done and what cannot; and by suggesting new features that should be made parts of them. (p. 5)

A psychological analysis of teaching and learning, if written 50 years ago, would have stressed classic theories of learning, relying heavily on such concepts as stimulus, response, conditioning, reinforcement, punishment—theories still being inflicted on students sitting in their introductory psychology courses. Contemporary psychology's analysis of teaching and learning is faithful to the idea that learning is a relatively permanent cognitive, behavioral, or emotional change resulting from experience, but as researchers burrowed more deeply into Skinner's (1953) black box, they discovered all sorts of psychological processes—memory systems, schemas, unconscious cognitive processes, motivations, traits, and so on—that augment the processes studied by the behaviorists. The law of effect (which states that behaviors followed by rewards occur more frequently) still shapes how students learn, but we also know that the kinds of learning that occur in college classrooms depends as much on cognitive, motivational, personal, and interpersonal processes as it does on behavioral ones (Reynolds & Miller, 2013).

COGNITIVE PROCESSES

What mental processes sustain students' learning? A psychological explanation usually starts by examining how people process information (Schank, 2011). Learners, we hope, are busily taking in information through their senses. They see, for example, the professor's scrawls on the chalkboard or hear the comments made by another student during class discussions. If they encode this information, the system translates it into an internal, psychological representation that is held briefly in working memory. At the same moment, however, the information-processing system is also retrieving data from long-term memory stores, for the human memory system is quick to associate the new with the known. In consequence, new (short-term) memories are aligned with existing (long-term) memories in a dynamic, active process (consolidation). This process is so dynamic, in fact, that most researchers assume information is constructed rather than simply stored. As the cognitive scientist Ulric Neisser (1967)

put it, we are like paleontologists working with fossil evidence, for "out of a few stored bone chips we remember a dinosaur" (p. 285).

In some cases this system encodes, constructs, and consolidates information almost effortlessly, but the kind of deliberative, intentional processing needed to learn complex subjects is challenging. If Noah is texting on his smartphone, he may not hear what the lecturer is saying. If Sophia is worrying about a personal problem, the cognitive load may be so great that she cannot process the topic the class is discussing. If Liam reads the textbook and memorizes key facts and terms, but does not link the information to his stock of memories, he will learn only at a surface level rather than a deep level. If Emma is so unfamiliar with the topic covered in class that she has no way to cognitively organize the information flooding into her working memory, she may be unable to retrieve that information even though she made a diligent effort to create durable memories of it. If Jacob, in contrast, has a well-formed set of organized information about a particular topic, he may not remember information that is inconsistent with his existing memorial inclinations. If Olivia is feeling happy on the day she learns about the constructivist model of memory, she may not be able to retrieve those memories if she is sad and lonely on the test day. 'Tis considerable strain twixt the teaching and the brain.

Studies of learning quite naturally tend to focus on how information is encoded; consolidated in memory; retrieved; and used for making rational, well-informed decisions. However, this superb information-processing system, engineered by the challenges of a threatening social and physical environment, is not just an objective fact finder and information processor but a motivated system that seeks meaning, self-assurance, control, and inclusion. The same system that wants to identify why it missed the question on the test about field reversal across a first-order boundary of an Ising ferromagnet would prefer to blame the teacher, the test, or the text rather than one's finely tuned information-processing system. The same system that can decide when to use the words *comprise*, *literally*, and *reticent* correctly is also calculating the strength of its social network based on Facebook cover photo likes. The same system that can follow the professor's complex arguments about the differences between Derrida's concept of *deconstruction* and Heidegger's notion of *destruktion* is also calculating the odds of hooking up with the attractive student two rows over. The cognitive system processes all information, including that which is not strictly curricular.

MOTIVATIONAL PROCESSES

Why are some students more involved in class, better prepared for discussions, quicker to ask questions, and striving harder than other students with equal or better ability? A psychological explanation usually

invokes the somewhat mysterious dispositional quality of *motivation* to explain relatively stable differences in purposeful engagement in academic tasks and study. Certainly some students come to the classroom ready to expend considerable time and effort in their quest to learn the course material and achieve personal goals of success. For many students, though, the motivational pump is unprimed. They are dogged in their pursuit of the goals that they themselves chose, but those goals may not be aligned with ones set for them by their parents, professors, major, school, or society. Students often have jobs and other life experiences to contend with, and these extracurricular activities may be far more exciting or involving than the act of learning. Students are energized by the prospect of pursuing a valued goal—earning the top grade in the class, writing a paper of such quality that it garners the professor's glowing praise, or mastering a complex field of study—but not if their intuitive odds calculator warns them that the probability of success is vanishingly small. In other cases, students' motivation drops down to nil as their initial interest in learning is wiped away by hours of uninspired lectures or too many low quiz scores (Brophy, 2004).

Teaching and learning are also emotional experiences. Like motivations, emotions guide behaviors, prompting people to move in directions that they associate with positive feeling states—happiness, contentment, pride, satisfaction, and the like—and away from people, places, and activities that engender the negative emotions: annoyance, anger, sadness, distress, and so on. Also, although extracurricular activities may offer no end of opportunity to maximize positive emotions, the hard work of learning often generates more negative ones. When, for example, the tests are handed back and the grade scrawled on the front page is less than what was desired, students may experience surprise, guilt, shame, resentment, or anger. These emotions may serve an adaptive function by providing the motivational energy students need to improve their work, but they may also trigger psychological responses that interfere with learning, such as withdrawal, denial of responsibility, and even depression.

Professors, despite stereotypes that stress their predilection for pondering rather than emoting, are by no means immune to the social and psychological processes that instigate emotional experiences. Many experience considerable happiness, satisfaction, and well-being as they help college students reach their learning goals. The college class can, however, be emotionally distressing for professors just as it is for some students. When professors learn, for example, that their evaluations at the semester's end were negative rather than positive, they report feeling *worried, angry, distressed,* and *upset. Lost, alarmed, stressed, negative,* and *defensive* also made the list. Professors, like most people, do not like feeling they have failed (Forsyth, 2012).

PERSONAL PROCESSES

Who are these students who populate the rosters of our courses? What are they like, as individuals, and what characteristics do they tend to share with their fellow students? There are, of course, aspects of individual learners that influence how they respond to different types of teaching modes and methods. For example, students whose epistemological model of knowledge leans toward the simplistic rather than complex side do not learn well when they must integrate information from multiple sources (Pieschl, Stahl, & Bromme, 2008). Students whose self-esteem is so high that they can be considered narcissists are more likely to cheat in college than are students with lower levels of self-admiration (Brunell, Staats, Barden, & Hupp, 2011). Some students are confident in their ability to use online resources in their classes, but others lack Internet self-efficacy (Kuo, Walker, Schroder, & Belland, 2014). Some individuals prefer to learn by reading textual information, whereas others favor charts, graphics, and other visual depictions of information (Kozhevnikov, Evans, & Kosslyn, 2014). Understanding the various learning modalities requires an understanding not only of the commonalities among students but also what differentiates each one from the others.

People differ in ways other than personality, and these *individual differences* (as they are termed in the jargon of psychology) are equally influential determinants of feelings, thoughts, and actions. Colleges were once populated by a relatively slim sliver of the population, and so heterogeneity was low and individual differences between students did not matter so much. But in 2016, over half of all graduating high school students will attend college, so the undergraduate student body is nearly as diverse as the population it samples. Students differ in ethnic, cultural, and socioeconomic background, religious affiliation, sexual orientation, and age, and these differences are systematically related to their interests, their level of academic preparation, and their familiarity with the norms and procedures common to, but often taken for granted, on college campuses.

INTERPERSONAL PROCESSES

A psychological analysis of teaching and learning recognizes the cognitive, motivational, and personal processes that influence the acquisition of new ideas, insights, and skills, but it also considers the interpersonal processes that inevitably come into play when people work collaboratively to learn from one another. Teachers and learners are linked together in a social relationship that may remain formal and unsubstantial or grow into one that is warm and influential. Each communicates regularly and richly with one another, exchanging information about the many and varied concepts examined in the course as well as creating a social connection that will help them understand one another. In most cases,

too, professors work with students collectively, and thus learning is influenced by the dynamics of the classroom groups. Students in classes compete for status, compare themselves to one another, form strong friendships, and help one another (sometimes even when they should not), so a class is more of a social network than an aggregation of independent learners. And even when students are learning through the solitary study of text, film, art, or music they are nonetheless responding to another person's thoughts, ideas, and artifacts. Technology has evolved to the point where students can learn from teaching programs that move them along in their lessons with great efficiency, but automated methods of instruction do not generate as much enthusiasm as more social forms of teaching and learning. Students and their professors are, after all, social animals.

EVIDENCE-BASED PRACTICES

A psychological perspective on college-level instruction and learning offers two basic suggestions to those who teach. First, be mindful of the undercurrent of cognitive, motivational, personal, and interpersonal processes flowing through even the most routine of educational experiences. Second, favor teaching practices that have been tested through some type of systematic empirical procedure, because even the most revered bit of wisdom about how to best teach can turn out to be misguided when subjected to scientific scrutiny. For example, even though many educators favor teaching students in ways that mesh with their own natural learning styles, scientific evidence offers little support for this recommendation (e.g., Hattie & Yates, 2014). Even though many college students believe their study techniques are effective ones, researchers who tested their favored techniques drew much more negative conclusions (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). Many professors are distrustful of the value of grading students' performance too frequently, but research has confirmed the *testing effect*: Answering questions is a sure-fire way to improve information retrieval (Brown, Roediger, & McDaniel, 2014). Even though students who are intrinsically motivated to learn course material enjoy their learning more, they are less likely to ace the course; it is the students who are motivated to outperform their classmates who generally get the best grades in college (Harackiewicz, Barron, & Elliot, 1998). Whereas some professors may insist that newfangled online teaching methods are a poor substitute for "real" teaching, meta-analytic reviews of online classes all point to one conclusion: Well-designed and well-delivered online classes are as educationally effective—and often more effective—than face-to-face traditional classroom experiences (Schmid et al., 2014). The question "What is the best way to teach a college class?" is an empirical one.

Because teaching and learning are complex processes, with multiple causes, influences, and concomitants, pointing to one factor as the crucial factor that must be considered will oversimplify more than inform. Consider, for example, this basic assumption: Students will learn more if they are rewarded for learning. This principle, based on B. F. Skinner's law of effect, has been supported in countless studies—it is called the *law of effect* for a reason. In certain circumstances, however, rewards backfire, in particular, when they undermine students' natural interest in the topic. But that does not mean that mush is all we are after. An engineer knows that the carrying capacity of a bridge is based on a 100 different factors, but still the bridge, when built, must carry cars and trucks from one side to the other. Learning has multiple influences, but the classes professors build must nonetheless carry the students from a place of confusion and uncertainty to a place of wisdom.

A Look Ahead

The study of teaching and learning is an ongoing process and a very human one as well. Mistakes are made, conclusions firmly held are found to be flawed, exciting findings cannot be replicated, and disputes and controversies emerge that split scientists into opposing camps. The study of human thought, action, and emotion provides only guidelines rather than definitive answers to questions about the causes of learning and how teaching should proceed.

Nonetheless, the research that has been conducted, and the insights that it has yielded, are considerable. Hattie's (2009) synthesis of 800 meta-analytic studies identified 52,637 studies conducted with millions of students in all types of classes and at all grade levels. That mass of research suggests that everything matters when it comes to teaching and learning: the characteristics of the student, the quality of the curriculum, the school itself, the skills of professors and teachers, and a panoply of social and cultural factors. Many of these influences are ones that professors can neither measure nor manipulate in any way, but others—the class's level of intellectual demand, the quantity and quality of feedback students receive, the instructional methods used during the semester, and the relationship that connects professor to student—are both influential and controllable. The chapters in this book, which I summarize here briefly, examine the many choices professors make about their teaching, beginning with their initial planning of the course and its basic content through to the final decisions about grades and assessing effectiveness.

ORIENTING: IDENTIFY YOUR PURPOSES AND PRIORITIES

Chapter 1 asks the question "What is college for?" The professor's original charge—to provide instruction for schoolteachers and religious leaders—has expanded beyond intellectual outcomes to instilling moral values, a work ethic, citizenship skills, and even Googling prowess. Is every one of these goals essential for achieving higher education's end result: the transformation of students into well-educated citizens? Professors are prone to rumination and so will want to identify, through judicious deliberation, the educational outcomes they are seeking in their teaching. After all, as that great expert on human behavior, baseball player and manager Yogi Berra (2002), once warned, "If you don't know where you're going, you might not get there" (p. 53).

PREPPING: ALIGN YOUR PURPOSES WITH PRACTICES

We need to know not only where we are going but also how to get there. Physicians preparing for surgery, high school students studying for the SAT, managers planning a new initiative, and college professors readying themselves for another semester of teaching benefit when they take time to plan, even if they do not necessarily end up following the plan. Rare is the professor who strolls into class on the first day of the term or signs into his or her online course learning system and just begins to teach; most spend many months planning their process. This planning must take into account not only the nature of the class to be taught and the kinds of students who take it but also the purposes of the class itself. All who teach must decide how they will teach by selecting the techniques they will use to help their students reach their learning goals. They must plan discussions, write lectures, select readings and texts, design assessments, and sequence the topics they hope to cover. Chapter 2 assumes that this extensive planning is essential for meeting one of the fundamental requirements for effective instruction: aligning purposes with practices.

GUIDING: USE STUDENT-CENTERED TEACHING STRATEGIES

A knowledgeable instructor, a textbook brimming with information, rich online resources, and carefully designed assessments will all be for naught if students are not engaged in their studies, that is, if they do not devote time and energy to their learning. The student-centered teaching–learning methods examined in Chapter 3 offer empirically

supported means of enhancing students' engagement in their learning. Discussions, learning groups, experiential activities, and other student-centered teaching methods, when properly executed, personalize and enrich the teaching–learning experience given that they bridge the gap between the conceptual and practical, the hypothetical and the concrete, and the uninteresting and the engaging. They require students to respond cognitively, behaviorally, and even emotionally to the material, and so they increase both intellectual understanding and personal engagement.

LECTURING: COMMUNICATE IN AN ENGAGING MANNER

Student-centered teaching methods are often called *active learning methods* given that they require more observable involvement by students in the teaching–learning process. But even professor-centered teaching methods—including the lecture—can trigger active learning when they draw students into the learning experience. Lecturers who stand at a lectern before a 400-person class (or appear as a talking head on the Internet) for an hour, reading from their detailed notes, with little variation in voice tone, likely fail to even reach the basic goal of transmitting information from teacher to learner, because the students cannot keep their minds focused on the lecture's content. However, as Chapter 4 explains, some lecturers know how to engage a class, provoking their students, stirring their emotions, and getting them thinking about questions they never before considered. That kind of learning is engaged learning, and that is the kind skilled lecturers can provoke.

TESTING: ALIGN TEACHING WITH EVALUATION

Developing effective ways to assess student learning is an essential component of good teaching. Tests provide the means by which to assign fairly grades based on student achievement, rather than whim or mood. Even though college students have years of experience in learning settings, many of them are still unable to calibrate their own learning; they do not always know when they have learned material and when they have not. Students also are not sufficiently skilled in regulating their time and motivation, so they need external goals to punctuate and validate their work. Chapter 5 reviews the basic steps professors should follow to ensure the validity of their testing methods, including identifying instructional goals, choosing among various types of tests (e.g., multiple choice, essay), writing items that assess students' attainment of the specified course goals, and evaluating the adequacy of the test through item analysis. The chapter takes seriously Thorndike's (1918) principle of measurement: "Whatever exists at all

exists in some quantity. To know it thoroughly involves knowing its quantity as well as its quality" (p. 16).

GRADING AND AIDING: GRADE THEM, BUT ALSO HELP THEM

Chapter 6 is based on one core principle: The learning cycle requires a constant flow of useful feedback. Few achievements can be evaluated without reference to some standard that defines which outcomes are correct, successful, or satisfactory. Grades provide that clarity while also providing students with an additional incentive and a concrete goal. A grading system that is truly fair should be coupled with a second system: one that provides students with the assistance they need to learn from their errors and improve their performance. Instructors who set high standards for students are rated more positively than easy graders, so long as they grade fairly and provide students with the resources they need to reach their preferred outcomes.

MANAGING: FOSTER CIVILITY AND INTEGRITY

Even though professors' top priority is promoting students' learning and achievement, they must also enforce basic principles of academic integrity, civility, and tolerance. Classroom management, the focus of Chapter 7, includes all those "actions taken by the teacher to establish order, engage students, or elicit their cooperation" (Emmer & Stough, 2001, p. 103). A class is a social milieu, complete with norms, roles, relationships, cliques, statuses, conflicts, competitions, and other assorted interpersonal processes. These social dynamics sometimes contribute to the energy for and engagement in both the teaching and learning, but they can also be more disruptive than promotive. Of these difficulties, violations of academic integrity are the most significant in terms of their effects on the teaching–learning process. The student who shows no remorse when he naps in class each day may be irritating, but the student who cheats crosses a line that should not be crossed.

UPGRADING: USE TECHNOLOGY APPROPRIATELY

Despite the predilection for discomfiting terminology, such as *tweets, moocs, blogs, wikis, mashups, hypertext, podcasts,* and the like, technology offers professors new ways to reach their long-established goals. Some technologies, such as in-class projection systems, smartphones, and mediascape learning laboratories, are changing the nature of the traditional classroom lectures, discussions, and physical laboratories. But

computer-based information technologies—most notably, the Internet— is the big player in the world of teaching technology: Each year, more classes move from bricks-and-mortar classrooms into virtual, online ones. A Gates Foundation survey of nearly 4,000 U.S. teaching faculty concluded that nearly 25% teach courses completely online, and another 20% teach blended courses in which at least 30% of the material is taught online (FTI Consulting, 2015). Chapter 8 reviews these innovations and their influence on teaching, for the effectiveness of these methods—like all tools—is determined by their consistency with pedagogical purposes and the skill of the user.

EVALUATING: ASSESS YOUR SUCCESS

In teaching, as in all things, many paths lead to excellence. One professor may be a superb lecturer who teaches listeners so stealthily they do not even realize their neural networks are being rewoven. Another may be the quintessential discussion leader who can draw out and organize students' viewpoints in a rich texture of insights. Others may develop novel methods of instruction, write textbooks that inspire students, or mentor colleagues in the craft of teaching. The steps taken in the evaluation of teaching discussed in Chapter 9 must reflect this diversity. Because professors reach excellence through many different paths, one must cast the net widely if one is to catch all the information needed to evaluate teaching. Teaching can and should be evaluated but, as with so many things in life, the easy way of doing something—in professors' case, surveying students—is not necessarily the best way.

DOCUMENTING: DEVELOP A TEACHING PERSONA

Professors are, in a sense, historians who are writing and revising their own autobiography. Each experience, each event, and each new insight adds to that ever-expanding archive of information that defines who they are, as individuals, as academics, and as educators. That history likely includes research, scholarship, and intellectual achievements, but a portion is also defined by their teachings: what they have done, across their career, to promote their students' achievement of their learning goals. A professor's teaching responsibilities are staggering, but Chapter 10 warns that the work in and out of the classroom can be overlooked and forgotten if it is never documented. Many teaching professors therefore gather together the artifacts of their teaching in a portfolio or dossier that describes their involvement in, and success at, teaching. Portfolios describe the teaching professor's work, guide development, and encourage innovation but, more important, they make explicit professors' central role in higher education.

The Idea of It All

College professors are not just philosophers, theoreticians, research-ers, artists, scientists, and engineers; they also are educators. We are charged with a crucial responsibility: the transformation of our students into college graduates who possess the skills and capabilities that impri-matur promises. We effect that transformation by designing classes that inspire, motivate, and inform our students; by selecting and imple-menting effective methods of instruction; and by skillfully assessing our students' success in reaching their educational objectives. However, because we are rarely trained in instructional design, our practices—as impressive as they are—are often informed only by our personal expe-riences as learners, the well-meaning advice of colleagues, and feedback from students.

This book draws on a different source of information about teaching—theory and research in psychology—to offer insights into 10 key aspects of college-level teaching: (a) identifying purposes, (b) course planning, (c) student engagement, (d) lecturing, (e) assessment, (f) grading, (g) class-room management, (h) using technology, (i) course evaluation, and (j) developing a portfolio. For those who are new to teaching, the book, which is organized so that topics are covered in the order they gain our attention during the course of the semester, provides a guide one can follow from the semester's start to its end. Experienced teachers, in contrast, may use the book to gain new insights into issues that remain unsettled, even when viewed through eyes that have seen many classes, many students, and many changes to higher education itself.

How you use *College Teaching* depends on you and your purposes, but no matter what your experience or interest, I hope this book kindles (or rekindles) your curiosity about how people learn new things and that it prompts you to wonder again about how the students in your classes are transformed by what you do.