Random Thoughts . . .

THE 10 WORST TEACHING MISTAKES
II. Mistakes 1–4

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In our last column[1], we presented the bottom six of our top 10 list of the worst mistakes college teachers commonly make. Here are the top four, with #4 being particularly applicable to engineering instructors.

Mistake #4. Give tests that are too long

Engineering professors routinely give exams that are too long for most of their students. The exams may include problems that involve a lot of time-consuming mathematical analysis and/or calculations, or problems with unfamiliar twists that may take a long time to figure out, or just too many problems. The few students who work fast enough to finish may make careless mistakes but can still do well thanks to partial credit, while those who never get to some problems or who can't quickly figure out the tricks get failing grades. After several such experiences, many students switch to other curricula, one factor among several that cause engineering enrollments to decrease by 40% or more in the first two years of the curriculum. When concerns are raised about the impact of this attrition on the engineering pipeline, the instructors argue that the dropouts are all incompetent or lazy and unqualified to be engineers.

The instructors are wrong. Studies that have attempted to correlate grades of graduates with subsequent career success (as measured by promotions, salary increases, and employer evaluations) have found that the correlations are negligible[2]; students who drop out of engineering have the same academic profile as those who stay[3]; and no one has ever demonstrated that students who can solve a quantitative problem in 20 minutes will do any better as engineers than students who need 35 minutes. In fact, students who are careful and methodical but slow may be better engineers than students who are quick but careless. Consider which type you would rather have designing the bridges you drive across or the planes you fly in.

If you want to evaluate your students' potential to be successful professionals, test their mastery of the knowledge and skills you are teaching, not their problem-solving speed. After you make up a test and think it's perfect, take it and time yourself, and make sure you give the students at least three times longer to take it than you needed (since you made it up, you don't have to stop and think about it)—and if a test is particularly challenging or involves a lot of derivations or calculations, the ratio should be four or five to one for the test to be fair.[4]

Mistake #3. Get stuck in a rut

Some instructors teach a course two or three times, feel satisfied with their lecture notes and PowerPoint slides and

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assignments, and don't change a thing for the rest of their careers except maybe to update a couple of references. Such courses often become mechanical for the instructors, boring for the students, and after a while, hopelessly antiquated.

Things are always happening that provide incentives and opportunities for improving courses. New developments in course subject areas are presented in research journals; changes in the global economy call on programs to equip their graduates with new skills; improved teaching techniques are described in conference presentations and papers; and new instructional resources are made available in digital libraries such as SMETE (<*www.smete.org*>), Merlot (<*www.merlot.org/merlot/index.htm*>), and the MIT Open Courseware site (<*http://ocw.mit.edu*>).

This is not to say that you have to make major revisions in your course every time you give it—you probably don't have time to do that, and there's no reason to. Rather, just keep your eyes open for possible improvements you might make in the time available to you. Go to some education sessions at professional conferences; read articles in educational journals in your discipline; visit one or two of those digital libraries to see what tutorials, demonstrations, and simulations they've got for your course; and commit to making one or two changes in the course whenever you teach it. If you do that, the course won't get stale, and neither will you.

Mistake #2. Teach without clear learning objectives

The traditional approach to teaching is to design lectures and assignments that cover topics listed in the syllabus, give exams on those topics, and move on. The first time most instructors think seriously about what they want students to *do* with the course material is when they write the exams, by which time it may be too late to provide sufficient practice in the skills required to solve the exam problems. It is pointless—and arguably unethical—to test students on skills you haven't really taught.

A key to making courses coherent and tests fair is to write *learning objectives*—explicit statements of what students should be able to do if they have learned what the instructor wants them to learn—and to use the objectives as the basis for designing lessons, assignments, and exams.[5] The objectives should all specify observable actions (*e.g.*, *define*, *explain*, *calculate*, *solve*, *model*, *critique*, and *design*), avoiding vague and unobservable terms such as *know*, *learn*, *understand*, and *appreciate*. Besides using the objectives to design your instruction, consider sharing them with the students as study guides for exams. The clearer you are about your expectations (especially high-level ones that involve deep analysis and conceptual understanding, critical thinking, and creative thinking), the more likely the students will be to meet them, and nothing clarifies expectations like good learning objectives.

Mistake #1. Disrespect students

How much students learn in a course depends to a great extent on the instructor's attitude. Two different instructors could teach the same material to the same group of students using the same methods, give identical exams, and get dramatically different results. Under one teacher, the students might get good grades and give high ratings to the course and instructor; under the other teacher, the grades could be low, the ratings could be abysmal, and if the course is a gateway to the curriculum, many of the students might not be there next semester. The difference between the students' performance in the two classes could easily stem from the instructors' attitudes. If Instructor A conveys respect for the students and a sense that he/she cares about their learning and Instructor B appears indifferent and/or disrespectful, the differences in exam grades and ratings should come as no surprise.

Even if you genuinely respect and care about your students, you can unintentionally give them the opposite sense. Here are several ways to do it: (1) Make sarcastic remarks in class about their skills, intelligence, and work ethics; (2) disparage their questions or their responses to your questions; (3) give the impression that you are in front of them because it's your job, not because you like the subject and enjoy teaching it; (4) frequently come to class unprepared, run overtime, and cancel classes; (5) don't show up for office hours, or show up but act annoyed when students come in with questions. If you've slipped into any of those practices, try to drop them. If you give students a sense that you don't respect them, the class will probably be a bad experience for everyone no matter what else you do, while if you clearly convey respect and caring, it will cover a multitude of pedagogical sins you might commit.

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