HELPFUL HINTS FOR EFFECTIVE TEACHING

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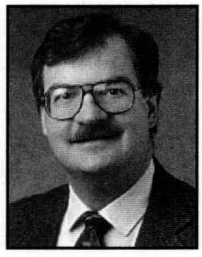
A few years ago, when I was new as Chair of Chemical Engineering at the University of Colorado, my colleagues and I felt the need to take action to improve our teaching. The idea was born, in part, out of a sense of frustration in trying to communicate effectively with students in the face of increased enrollments in our courses at the time.

As a starting point, we held a brainstorming workshop attended by (nearly) all faculty. We next formed small groups, each with the same task of making a list of effective teaching attributes. Each group then presented its findings, which were discussed and organized into four categories:

- *Course Organization and Preparation*
- *Classroom Communication*
- *Rapport with Students*
- *Assignments, Examination, and Grading*

In preparation for our workshop, I prepared a handout of hints for effective teaching that I later revised with the insights gained from the workshop. Since it is easy to lose focus of our primary responsibility as educators and to fail to set aside ample time for helping our students learn, I make it a habit to review these hints several times a year. I have also given this handout to our all of our faculty.

What follows is the most recent version of the handout, with annotations in italics added for this article. The reader should understand that it is not a systematic or complete scholarly work on teaching, but rather one that has evolved from my experiences and those of my colleagues. In this sense, it has a similar flavor to several other recent articles[1-3] on personal perspectives, and many of the conclusions are ones of common sense and experience. I encourage the reader to also consult more thorough studies and discussions of teaching methods and learning styles.[4-6]



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COURSE PREPARATION AND ORGANIZATION

- ◪ Ask to teach courses related to your expertise. *Your knowledge of the material and your enthusiasm, both ingredients of effective teaching,[7] will be highest in such courses.*
- ◪ Outline the entire course in advance. *A logical presentation of the material will be most effective if you decide up front what the course learning goals are, what topics are to be covered, and how much time should be spent on each topic, and then prepare a detailed (two to four pages) numbered outline that is used throughout the course.*
- ◪ Prepare well-organized notes for each class period. *It is easy to get into (and hard to get out of) the pattern of preparing for a class the night before (or even the same day). While this approach works for some of my colleagues, I am more relaxed if I prepare a week or more in advance.*
- ◪ Set aside at least thirty minutes right before each class period to review the materials and to focus your thoughts.
- ◪ Read and assimilate several sources in addition to the assigned text. *Your course should have your personal touch and should be prepared in a style and sequence that makes sense to you, rather than just following a text. I recommend that you go through several books, journals, popular press, and notes from other faculty to*

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select your materials.

- ◪ On the first day of class, give the students a course syllabus that includes the course goals, an outline, reading assignments, homework expectations, exam schedule, and grading policies.
- ◪ On the first day of class, and periodically throughout the term, discuss the relevance of the course material to practical applications and to the rest of the curriculum. *If we want students to learn, then we must provide motivation on why the material is important.[7] Even better, ask them to brainstorm on real-life applications and tie-ins with other courses, either in small groups or in an open-class discussion.*
- ◪ Provide and discuss review sheets prior to each exam. *These help the students see the big picture of what they (should) have learned and how it ties together.*
- ◪ Your course outline, notes, and materials should be reviewed and updated each time you teach the course.

CLASSROOM COMMUNICATION

- ◪ Put an outline on the board and provide a preview at the beginning of each class period, whether giving a lecture or using another style; use a brief review of the previous class period as a transition.
- ◪ Summarize the key points, with the help of students, at the end of each class period.
- ◪ Come to class well prepared and undistracted, so that you are less likely to stumble over derivations or solutions. *If you do make a mistake, admit your error. If you get stuck, promise the students that you will find the answer for next time; do not bluff.[1]*
- ◪ Do not read your notes to the students. *Simply reading lecture notes or from a book is a sure way of turning off the students' learning processes.[8] While some gifted faculty can deliver an entertaining and factual lecture with no written materials, I am most comfortable with a middle-of-the-road approach where I bring about five pages of handwritten notes to a 50-minute class period—about half of them represent material that I put on the board for the students and the rest is highlighted prompts to me on questions, illustrations, stories, etc.*
- ◪ Write neatly on the board or overheads, use visuals, and give students sufficient time to take notes. *Board use should follow an orderly and logical progression, the physical layout of which should be visualized in advance, and include numbered headings consistent with the course and class outlines. Visuals (pictures, drawings, graphs, charts, etc.) are excellent learning tools.[7] When using overheads, it is especially important to give students time to write down what is necessary—or to provide them with copies of the overheads. I like a mix of writing on the board for the main part of the lecture, interspersed with breaks where I pass out a one-page handout of an example or derivation that I then go through quickly using an overhead.*
- ◪ Ask questions in order to maintain the students' focus and assess their understanding of the material. *Well-formulated questions should stimulate the students' thought processes.[10] Give the students plenty of time to answer the questions, and provide prompts or hints, if necessary. I sometimes call on students by name; this must be done with courtesy and respect, as some students prefer to remain in the background. A student must never be embarrassed or ridiculed for not knowing the answer.*
- ◪ Use examples in class that students can relate to. *In a heat-transfer course, discuss why the same temperature "feels different" in dry air, humid air, water, and wind. In a fluids course, calculate how much the shower temperature will go up when the toilet is flushed, and suggest an alternative plumbing design that minimizes this effect.*
- ◪ Start and end the class period on time, and gently but firmly maintain order.

RAPPORT WITH STUDENTS

- ◪ Learn each student's name. *While this is more difficult with larger classes, suggestions include asking each student to write a short biographical sketch on the first day of class, taking photographs, handing back homework individually just before the start of class, greeting students by name, and asking students their names when you don't know them.*
- ◪ Schedule at least two office hours or optional-help sessions per week at times available to the students. *One should be the day before an examination is held or homework is due, and the other(s) earlier in the cycle.*

Most important, be present for your office hours and inform the students and reschedule those times for which there are unavoidable conflicts.

- Be willing to see students outside scheduled office hours and help sessions. *One of the most difficult issues we face is how to make availability to students a high priority when there are so many other demands on faculty time. When students drop by, my intention (though I often fall short) is to set other things aside and listen and help. If meeting their needs will take longer than I can spend at that time, then I set up an appointment. To make the necessary uninterrupted time for writing and other tasks, I come in early; others may prefer to stay late or spend part of the day working at home.*
- Be attentive and sympathetic to students; do not say anything that might make a student feel put down, either in public or in private. *The most common student complaints that I receive as Department Chair is that they have not been treated with respect by faculty. While insensitive words or actions are often unintended, we must never lose sight of our calling to serve and encourage our students.*
- Take at least one class period, or parts of two or more, to dispense with the course material and discuss a subject such as professional ethics or your own experiences.
- Solicit and respond to mid-course feedback by a group interview or evaluation questionnaire. *Using class representatives or peer evaluation can also yield useful feedback while there is still time to make changes.*[3,11]
- Provide food. *At help sessions, during special occasions in class, or for an end-of-term party.*
- Understand that relationships with students do not end with the course. *If you show students that you care, then they will naturally ask you to write recommendations and provide career advice.*[2] *Some will come to you with personal problems (know when to seek help from campus professionals). Some will stay in touch for years. These are some of the responsibilities and rewards of our profession.*

ASSIGNMENTS, EXAMINATIONS, AND GRADING

- Inform the students of the course grading scale or method at the start of the course. *The second most common complaint that I receive from students involves grades—that they were not informed by the instructor that a certain exam would make up half of their grade, that they were not told what performance was required to get a "B" in the course, or that a friend received a higher grade with the same or lower scores.*
- Make sure that the exam problems correspond to the course objectives and learning goals, which should be the major topics of the class periods and homework assignments. *Students learn more when they are actively involved,*[7] *and one of the best activities is homework on carefully selected problems.*
- In each assignment and examination, include a mix of simple, medium, and difficult problems. *Since students learn and demonstrate knowledge in different ways, it helps to include a variety of exercises.*[7]
- Develop solutions for all homework and exam questions before they are handed out, and work the problems yourself. *Not only does this serve as a check that the problems are reasonable, but it also gives you the necessary preparation for answering questions.*
- Grade as thoroughly as time allows, providing comments and partial credit. *Careful grading is needed for fairness and consistency, and it provides important feedback to the students. This requires time; if necessary, use this article to help convince your department to invest adequate resources in graduate and undergraduate course assistants.*
- Return graded homework, exams, and reports promptly. *Students want feedback.*[7] *More important, prompt grading shows students that they are a high priority.*

These hints for effective teaching can be summarized in one word: *time.* It takes time to prepare a course well; it takes time to know students. If we care deeply about students and their learning, then teaching will be a high priority among our other responsibilities and we will take the time to do it well.

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