A System for Upper Undergraduate Teaching

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Over the last few years, I have re-organized my undergraduate classes in a system popular with students and manageable for me as a teacher. It has three components.

1. Lectures. These are pretty standard. I write down almost everything I say, in words and in symbols, with chalk (which is far superior to slides in penetrating the minds of the audience). I pause and approach the audience when asking a question and waiting for an answer, or when making a philosophical point.

I introduce each topic with an example (preferably pictorial) before stating a general result. I stress definitions and theorems, and keep proofs short and few, though occasionally a revealing proof is a worth a lecture. I often wrap up a topic with a difficult example, to give a sense of achievement.

Throughout, I emphasize how the specific techniques fit into general priniciples. Preparation and time-management are important in making each lecture a coherent whole, having one main point each time. The lecture material and the overall themes become clearer in each iteration of the course.

2. Daily homework with solutions. Every day after class, I post notes, reading, and homework on the class web-page. This is laborious the first couple of times I teach the course, but later it is mostly copy-and-paste from the long accumulated file (about 45 typed pages for Math 481). I modify the division of the problems based on what I covered that day, and occasionally add a new problem.

I do not collect daily homework, but give solutions on a separate page. These tempt the students to skip working the problems, but this is discouraged by the next day's quiz. The daily posting includes web links to relevant material like Wikipedia (quite sophisticated and trustworthy) and Khan academy (for elementary review).

In addition, I assign several proofs as hand-in "essay"assignments, with initial work handed back for a second draft. There are numerous extra-credit problems.

3. Daily quizzes. Each lecture begins with a 5-to-10 minute quiz based directly on the previous night's homework. The problems are close to the level of exam questions and are not feasible unless the student has understood the homework. This gives strong motivation to work the problems and keep up with the material.

Besides the main effect, the quizzes encourage class attendance and give continuous feedback between student and teacher: I can track every absence on my grade sheet, and see quickly when a student or the class did not comprehend. A generally bad quiz performance sometimes prompts an extra lecture on a topic. The quizzes also provide a ready study guide for exams.

The best side-effect of the quizzes is that, in grading and handing back the quizzes, I learn each student's name and seat, and I grade their work three times a week. All 30-odd students in Math 481 are now individuals to me, which is one of the crucial factors in getting through to them.

I am experimenting with one more component: office hours. Some face-to-face discussion would benefit almost all students, but an office visit is out of the way and somewhat forbidding. This semester my class is in Berkey Hall, and I have invited the students to drop in before class to the teahouse just across the street. This has been fairly successful: more students come, the discussion is more casual, and we can access the web on tablet computers.

Links to old and new course pages at: `www.math.msu.edu/~magyar`