Random Thoughts . . .

HANDOUTS WITH GAPS

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When you've given enough teaching workshops, you start to anticipate certain questions from the participants. In our workshops, for example, as soon as we mention active learning we can count on someone immediately asking how they're supposed to cover their syllabi if they start filling their lectures with activities.

When we get that question we trot out one or more of three responses. First, the point of teaching is not coverage, but learning. If you cover something and most students don't learn it, you haven't taught it. Second, you can have a major impact on learning by including just a couple of minutes of activity in a 50-minute class, which won't do irreparable harm to your syllabus coverage. Our third response not only preserves your syllabus but allows you to extend it while doing all the active learning you want to. This response does double duty, since it also answers another FAQ: How can I catch up with my class schedule when I fall a week or more behind, as I invariably do in every course I teach?

Here's how: *use handouts with gaps*. Put your lecture notes in class handouts or (if you have the complete set of notes) a coursepack, but not the complete notes. Show straightforward parts of the lecture material—definitions, facts, simple math, diagrams, and plots—with interspersed blank spaces (gaps) for students to insert answers to questions, missing parts of problem solutions and derivations, and visuals such as molecular, physical, and biological structures, free-body and circuit diagrams, and process and algorithm flow charts. In class, give students brief periods of time to read the straightforward parts themselves, and use lecturing or active learning to fill in the gaps.

An illustrative page from a handout for an introductory fluid dynamics course is shown at <*www.ncsu.edu/felder-public/Columns/FDHandout.pdf*>. (We suggest you bring it up now—it will make what follows more comprehensible.) If you were conducting this particular class session, you would begin by asking the students to open their handout or coursepack to page 35 and read the top half of the page, which contains a simple description of fluid flowing in a pipe. You would stop them when you think they've had enough time and ask if they have any questions (they generally don't). You've just saved a chunk of time relative to a traditional lecture, since the students can read much faster than you can speak and write.

Next comes a problem statement ("*Derive an expression for the mass flow rate…*") and a gap for the solution. There are three different things you can do at that point.

1. ***Lecture on the material that goes in the gap.***

Tell the students that what they just read is straightforward but that derivation is tricky and students often have trouble with it, and then go through it as you would in a traditional lecture. The idea is to focus most of the class time on material the students really need help with, as opposed to spending a lot of it on definitions and simple calculations that the students can quickly read through on their own.

2. ***Use active learning[1] to get students to fill in the gap.***

A more effective strategy is to tell the students to get into groups of two or three and give them a short time to go as far as they can with the derivation, then stop them and call randomly on several to report on the steps they carried out.

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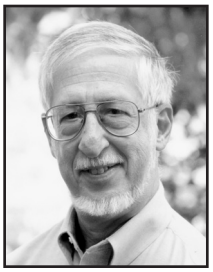

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Write correct responses on the board so everyone in the class gets them. Some students will work out the derivation and so will own it, because they did it themselves rather than just watching you do it and imagining that they understood all of it. (Few students understand complex material when they just listen passively to a lecture on it.) Others will try but won't get the solution in the allotted time. As it goes up on the board, though, most of those students will pay careful attention, ask questions if necessary, and understand it by the end of that class session.

3. ***Leave filling in the gap as an exercise for the students to complete outside of class.***

Tell the students that you don't plan on going over a gap in class, but they should make sure to find out what goes in it before the next test. They can work with each other and ask about it in class or in your office if they can't figure it out themselves. If you fall behind your lecture schedule, increase your use of this option for easier and less important material.

Rich used handouts with gaps for the last 20 years of his active teaching career. Even though he also used active learning extensively, his syllabi actually got longer than they were when he felt it necessary to say every word and draw every diagram and work through every step of every derivation and problem solution in class. The brief struggles the students had in class followed by immediate feedback saved many of them from hours of wrestling with similar exercises in the homework.

Research has confirmed that handouts with gaps have a powerful impact on learning and performance on assignments and tests. In several studies, students who got incomplete notes on course material earned higher exam grades, higher course grades, and higher marks on conceptual questions than students who had complete notes.[2–4]

Faculty members sometimes raise objections to the concept of handouts with gaps.

***Objection 1:* Students learn a lot by taking notes in class. If I give them most of the lecture notes in handouts, they won't bother taking their own notes and will learn less.**

Response: The research says otherwise. When students are busy copying definitions, tables, figures, equations, and simple mathematical operations, they can't simultaneously pay full attention to explanations in the lecture, and they consequently miss important material.[5]

***Objection 2:* Putting my complete lecture notes into handouts with gaps will take much more of my time than I can afford to spend.**

Response: What takes huge amounts of time is preparing the notes in the first place. Once you have them, it doesn't take much additional time to add gaps by pasting physical or electronic blank rectangles over responses to questions, calculations, and drawings you want students to complete.

***Objection 3:* My students think I'm obliged to tell them everything they need to know. They'll complain if I leave gaps in the course handouts, and they may completely revolt if I make them fill the gaps in themselves.**

Response: Complete revolt over gaps is unlikely but you can count on some students complaining about them, just as you can count on complaints about active learning. Fortunately, you can take steps to defuse or eliminate student resistance to those and all other learner-centered teaching methods.[6] Taking some of those steps—including offering to share the research showing that the method leads to higher grades—should keep the pushback at a manageable level long enough for most students to realize that what you're doing is in their best interests. At that point the complaints generally stop.

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