

## GRADUATE STUDENT TEACHING SEMINAR PREPARING A LECTURE

### FIRST STEPS

Books are notoriously filled up to the brim with stuff nobody needs or wants to know... You will soon notice that only a small part of the book is really relevant for teaching the material. Focus on the main concepts and outline a very tight and concise structure: this applies to every lesson and also for the whole course. The main work in preparing a lecture is to strip it down to its essentials. One always prepares too much, meanders too much, gives too much information which adds to confusion and etc. Cutting material out of a lecture is more important than adding material as long as the basic concepts are crystal clear.

Obviously you have to be on top of the material and have a bird's eye view of it. Think a lot about what you want to present and which points you want to emphasize.

Choose your examples very well; work from the specific to the general, motivate more abstract concepts in their simplest form. Again, it is better to do fewer examples than many of the same type (mechanical boredom).

Write out each lecture, edit it several times, weed out confusing stuff, reorder to make it as streamlined as possible, make sure it is logically consistent, preferably be a week ahead with your preparation and keep an overall plan for the whole semester in your mind's eye.

Mathematics was not developed like the books present it. The students get a completely wrong picture of what mathematics is. So you can sometimes give students a more organic, historically accurate view of how mathematics develops. But be careful not to confuse the students too much, maybe just a little bit to give them a glimpse what mathematics is really like....

Below you find a collection of thoughts, remarks, observations and suggestions from colleagues. There seems to be a common core:

- Begin the class with a quick review of the previous lecture.
- Give a preview of what you're going to discuss in the lecture.
- Interact with the class: show the students an interesting use of the material; ask them questions at good moments in the lecture; assign a problem and have them work in groups while you circulate and give help.

#### TIPS FROM PANOS KEVREKIDIS

- In the beginning of each class, I reserve about 1/4 of the board for a "What To Remember" section which they can use when reviewing the material for the main focal points of the lecture.
- In my "notebook notes", I may not always write everything out (at the calculus level). However, when I prepare the lecture, I do make a point of reciting it and of working out all the relevant examples, at least once in detail. This generally helps in significantly reducing the risks of tripping over details.
- I do invite the students to contribute some of the key ideas in the lecture (I stop and have them chip in something that they'd normally know, so that they feel they are also contributing to the building of new ideas). More importantly though (because the above only works well in an ideal world), I hand out practice problems which I stop and do once we finish a thematic entity (e.g. a section). This breaks the lecture monotony and allows me to see how they are doing (I walk around and monitor their progress, as well as give them hints).
- In regard to the last item (knowing how they are doing), I do spend 7-10 mins once a week also to give them a quiz which I grade personally so that I can single out relatively early (and especially after the 1st exam) who may be in danger of failing the class (and alerting them to it!).
- Form a class email list, and send the students weekly emails with what will be happening in the class both homework and exam-wise but also content-wise.

#### TIPS FROM JOHN STAUDENMAYER

- I try to make a one sentence summary of the goal for each class. That helps focus me.
- Some semesters, I've started each class with a fun and concrete fact or illustration of a common technique ("StatFacts"). Sometimes this is a review of something from a past class or a technique that we use over and over again (e.g. a Taylor expansion to approximate the probability of being hit by lightning.) or it can be something like an interesting stats website, where the stats books are in the library, stats journals students could read, a stats view of a newspaper article, etc.
- I sometimes have the students work on something during class while I circulate and help 1-1.

#### TIPS FROM JEFF BEAULIEU

- In the beginning of a class, usually, I'll summarize what we've covered, recently, to give context to what we're going to discuss that day. For example, in Math 121, perhaps we've been discussing solving systems of equations using graphing, substitution and elimination, and, now, we're going to discuss a fourth way, namely, Gauss-Jordan Elimination with Elementary Operations.
- Sometimes I'll write examples in my notes with answers and notes to myself on why I chose to use those particular examples. Sometimes I prefer to have the work for an

example done out in my notes so I can readily see any key step I wish to highlight or any tempting mistake I want students to avoid making.

- I tend to write an example on the board and say it as I write so students don't have to watch what I'm writing. They can just listen and write it down as I do (saves time for slow writers... also helps students in the back of larger classes who can't see as well).
- I'll work through an example or two for a concept, and then I'll likely give an example for students to work on. As they do, I walk around to help get them started and to get them moving when they get stuck. Sometimes I intentionally give them examples that will get them stuck so we can discuss why and what to do next. For example, in Math 121, when solving a  $2 \times 2$  system of equations using elimination, sometimes both variables get eliminated. What do we do now? What does this mean is going on, graphically, with the two lines? Is it a true statement or a false statement? What do they each mean in terms of the graphs?
- I teach the fast-paced Precalculus, so though I try to stick to the same formula (intro the material, do some examples, have students do an example or two while I walk around), most of this class is me at the board doing examples in order to get through the material. It's a review for most students, so, usually, they just need to see it to refresh their memory.
- The longer the class period, the more I try to break it up (fifteen minutes of me at the board, five to ten minutes for them to work on an example, me at the board, them working, etc... Sometimes I have them hand in their work on an example (class exercises), and sometimes I'll give them a 3-question mult-choice quiz. Anything to break it up and change modes (fifteen minutes is the most time you can expect most people to stay focussed in any one mode... at least this is what I've been told, and judging from classroom experience, I whole-heartedly support this conclusion).
- So all of that and firing any cell phones that go off across the room is a good way to have a successful lecture (and prevent any further cell phone interruptions... once in a while a laptop must also be sacrificed, but it's for the greater good).

#### TIPS FROM ADENA CALDEN

- Do out any example you plan to do the first time. You never know when you will accidentally end up making the problem unnecessarily harder than it needs to be by not working out the steps ahead of time.
- Add an extra example of each concept you are emphasizing. That way if the pace is faster than you expect you can throw a few in. Or if the students look confused you can have them try one/ work through another one.
- Try to get the class to interact with the examples you do. Ask questions like: What do you think we do next? Can anybody tell me how to start this problem? This works especially well if you have done a similar problem all the way through
- Have practice problems prepared for group work. Some students are afraid to ask the instructor if they are lost but will ask peers.

- When writing a lesson plan it is better to have too much written down than not enough. You can always skip stuff if you have too much on a topic but it is much harder to make stuff up on the fly.

#### TIPS FROM CAT BENINCASA

- I put a lot of time into my lecture notes. For many years I've use what I call "guided notes" - where I type up my lecture notes but leave parts of them incomplete, post them to my website where students can print them ahead of time and bring them to the lecture. Then we fill them in together (more or less). I will project them on the screen via my tablet pc and we go through the lecture together. This helps in many ways - but specifically for math131, it can be a time saver...i.e. examples are all written out ahead of time so class time doesn't have to be wasted with dictation/note scrawling. I like that it should also give students a heads up of what I'm covering so that they can choose to come to lecture or not based on whether they know the material - this isn't always the case - but I'd like to think it empowers them.
- I decide what I want to include mainly by what homework questions are assigned. I don't (obviously) include an example of every type of homework question but I try to include some simple examples of the concept to start out and then absolutely try to include some more difficult types that they are likely to see on homework.
- I don't make it all about just mechanics - I try to include the mathematics behind the mechanics and the "rules and regs", if you will. So the first page of my lecture notes almost always are rules and regs. I hone them into a format that will hopefully be easy for students to reference (i.e. not just a photocopy of the text book page). I then follow up with a bunch of examples. My new personal goal this year is to put MORE of the rules & regs on the front page FOR THEM so that we have more time in class to do examples together. So far I like it. i.e. on the notes I'm attaching, I just gave them all the limit laws rather than had them write them in during lecture. That way we had more time to work the examples I wanted to work. It also gives me more class time to allow students a few minutes to work on the examples before I go ahead and show them how. I will try to give them a minute or two headstart and then I'll jump in. Mostly because of time constraints and needing to stay on schedule with other classes.
- I personally work all my examples out ahead of time and bring my "key" to lecture with me. I am not a "think on my feet" kind of gal so I always have my own lecture notes with me in lecture. I don't always need them but I do have them just in case I get turned around on an example. I like being prepared.