Tips for Flipping

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"Flipping" is the current educational buzzword for "making students come prepared and using additional time to increase participation". Binghamton's flipped approach is very light, students are given resources on **introductory** material and take automated assessments before class and participation is used to supplement lecture in class. Instructors will be given daily tex files of problems to supplement lecture.

(I) Global Planning

- "Flipping" is only a pedagogy, it is up to an instructor to determine their individual style. Reflect upon how you interact with individual students, small groups of students, and the classroom as a whole.
- **GROUPS!** With 30-something students and limited time, it is more efficient to interact with groups of students over individuals. Depending on how you assess student participation, you can keep track of groups or allow student groups to remain fluid and informal. Groups of three work best as larger groups tend to form disconnected subgroups. If you keep track of groups, you should periodically regroup students.
- How do you organize your classroom participation? Carefully consider this before you enter your classroom! A class has momentum and it is incredibly difficult to change policies mid-semester. **Be generous with classroom participation grades, view this interaction as a FORMATIVE time for students!**
- Example: While preparing for lecture, highlight 1 to 3 problems from the tex file for grading. Aim to grade problems of easy to medium difficulty and save hard problems for yourself. When students find themselves lost on harder problems you have the perfect opportunity to guide them through a problem and (potentially) segue new concepts.
  - You can keep a checklist of which groups complete each problem. In this case, I would use beamer and not pre-release problem sets to students. Groups earn credit with a (mostly) correct write-up during class.
  - Alternatively, you can collect problems for grading. In this case, I would pre-release problem sets before class on Blackboard, informing groups during class which problems will be collected for grading. If you collect and grade problems, you should be sure to interact with students as they work!

  Brennan: I allow students to group themselves into sets of 2, 3, or 4; every few weeks I will allow students to regroup. Students sign-up on a sheet of paper and I create a spreadsheet to track groups. I use the spreadsheet to create a weekly checklist tracking group participation.

(II) Daily Preparation

- Take a few minutes to determine what information students are expected to be familiar with upon entering the class. Watch the videos and review the WebAssign problems while taking brief notes.

- Chunk up the major topics for your day and for each major topic list learning objectives.
- Plans always go awry and it's hard to stay within time, so you need to prioritize your list. Decide what absolutely needs to be covered in class and what can be scraped in a time crunch.
  * what should be lectured on? Can the average student comprehend a topic on their own?
  * what topics can be illuminated through problems?
  * what complexities will be missed by working the average problems? Lecture briefly on these after students work.
- It's important to have advanced problems and topics in reserve to entertain the quick students; it's never a mistake to have too much material at hand. As participation barely affects the final grade, don't be afraid to give an additional point for completion of advanced problems.

(III) In the Classroom

- Stick to your plan as best as possible, but be sure to hit major points and to stay roughly on track timewise for the major topics.
- If you find students cannot get off the ground working on their own, don't be afraid to ditch the flipped approach for that chunk. Some topics are difficult and time is an issue.
- Be prepared for fights from students. If they aren't coming prepared then don't hesitate to use guilt and their participation grade against them.
- After class, reflect on your planning and fine tune for the next class. If the class isn't keeping up or a topic wasn't adequately covered, then assign additional problems through webassign.

Section 2.9: Linearization and Differentials

Learning Objectives

- Lines are functions, even tangent lines.
- For nicely behaved functions, the tangent line at **a** can be used to approximate values near **a**.
- Find linear approximations of functions.
- Use differential notation to express the approximate change of a function over a small interval.
- Analyze how errors can be propagated through relationships.

Classroom Plan

(15 minutes) A brief review lecture on linearization highlighting the important concepts in the video. Present an example of approximating $\sqrt{0.9}$ using the linearization of $\sqrt{x}$.

(15 minutes) Students work problems:

- Estimate $\sqrt{0.9}$ using $\sqrt{1-x}$.
- (**Advanced:**) What is the difference between the two ways? Is one more accurate than the other?
- Use a linear approximation to estimate the value of $\sqrt[3]{9}$. (Grade this question.)

(10 minutes) Lecture briefly on the problems, clarifying misconceptions observed to be common amongst students.

(10 minutes) A brief review lecture on differentials highlighting the important concepts in the video.

(5 minutes) Discussion with students: Peeling an orange changes its volume V. What does ΔV represent?

a) the volume of the rind.

b) the surface area of the orange.

c) the volume of the "edible part" of the orange.

d) $-1\times$(the volume of the rind).

(15 minutes) Students work problems:

- Find the differential of each function:
  - $y = \sqrt{1+x^2}$
  - $y = x^2 \sin(x)$ (Grade this question)
  - $y = \sec\left(\sqrt{7x}\right)$

– **Advanced:** Use differentials to estimate the amount of paint needed to apply a coat of paint 0.1 cm thick to hemispherical dome with diameter 50 meters.

(10 minutes) Lecture briefly on the problems, clarifying misconceptions observed to be common amongst students. Completely work out the solution to the advanced problem.

(15 minutes) Students work problems:

The radius of a sphere is measured to be 84 inches with a possible error of 0.5 inches.

a) Use differentials to estimate the maximum error in the calculated surface area. What is the relative error?

b) Use differentials to estimate the maximum error in the calculated volume. What is the relative error? (Grade this question.)

This plan was created for Joseph Brennan's fall 2013, 90 minute section.