Teaching Philosophy

The essence of education is preparing students for the future. That goal is achieved by two main objectives: tangible and intangible learning. Examples of tangible outcomes include memorizing the quadratic formula, or the vector form of a plane in $\mathbb{R}^3$. Intangible benefits include the confidence to speak up in class when you realize you don’t know something, or else know where to look to figure it out on your own. A combination of these skills come together in “active learning” where one is constantly questioning why certain assumptions are necessary, or why certain results hold and how they could be applied to previously learned knowledge.

To facilitate these learning outcomes, it is my teaching philosophy that a mastery of base material is necessary before going onto more complex results. This is achieved by repeating themes, ideas, and theorems as they come up naturally throughout a course. Specifically, this ensures that (1) students gain mastery over material that will be assumed pre-requisite knowledge in later courses and (2) different sections of the course are connected by a common thread to avoid students feeling “lost”.

Broadly speaking, I view a course as having three components: lecture, homework, and exams. The in-class lecture should be responsive to student feedback, i.e. if students ask questions I can spend 5 minutes reiterating a concept. Additionally, the in-class lecture will cover base material so that everyone in the class has the same “floor” of knowledge. The purpose of homework is to both practice concepts introduced in class, as well as push students beyond the examples done in class. The motivation for this is that students essentially do not have time limits on homework, as well as have access to notes, so problem difficulty should be reflective of these facts.

Students are encouraged to do homework together, or even come to office hours for help. While homework is graded, the main emphasis should be on using homework as a tool to ensure students are learning the material. The online software WebAssign is used for this purpose, and so I can monitor specific student’s progress.

Exams compose the bulk of a student’s grade, and the emphasis should be on demonstration of knowledge. When writing exams, I classify questions into three “groups”: easy, medium, and hard. Easy questions are essentially repetition of simple concepts or definitions that show up throughout the unit, and essentially should be answerable by anyone who showed up to class. Medium questions aim to test whether a student practices homework/examples done in class. A medium question should only test one concept, and should not require any “connections” between concepts to be made. Hard questions link two or more concepts throughout the unit, and in particular the calculation might be more involved than for a medium-level question. This way, only students who understand the “bigger picture” of the technique will be able to work through the problem within the time constraints of an exam.
Style and Tools

The tools and habits I have developed in preparing and delivering lectures has been developed in order to maximize the ability of a student to understand what is expected of them. Lecture notes typed in \LaTeX and distributed (electronically), with blank space for filling in during class. This ensures that students who must miss class for excused absenses do not miss material.

During lecture, particularly 75 minute lectures, I like to take 5-7 minute breaks for “group exercises”. Group exercises provide (1) an opportunity for students to engage each other during class time and reinforce each other’s learning, and (2) provide a necessary break for longer classes, without which students start to become distracted and disinterested around the hour mark.

Visualization of graphs and relationships is very important. Most students don’t have sufficient mastery of the algebra to transform functional representations into mental images, so providing these to the student can dramatically increase understanding, as well as motivate the “meaning” of certain formulas. Additionally, I do all of my visualization with open-source, easily-accessible software so that the motivated student can do their own visualizations at home. The specific software I use depends largely on the course material. In multivariable Calculus, I use the open-source SageMath software [link]. For single-variable Calculus and PreCalculus, I use the free website Desmos.com [link].

Figure 1: Example of Sage code on my website to visualize a parametric surface (Torus). Students can “drag” the surface to move and rotate it and gain an appreciation for how parametric surfaces, represented by equations, are real objects.