Jeffrey K. Landgren

Teaching Philosophy

For me, being a teacher of mathematics means seeking two goals for students. The first is to uncover a curiosity for patterns and logic. As an applied mathematician, this can be enhanced by demonstrating these patterns in the physical world or practical concepts. The second is to equip my students with a set of reasoning skills to help them navigate through their curiosities. It is my hope that the end result provides an enriched environment in which they have learned to think for themselves and attack problems with confidence and selective inquiry.

One of the most important ingredients to teaching is organization. Being the teaching assistant for two graduate level courses (ODE's & PDE's) and the instructor for one graduate level course (Qualifying Exam Preparation Seminar) helped formulate my organizational skills. One such strategy I developed for both me and the students was creating a "bird's eye view" of the course. For many courses, a part of mastering a concept involves being able to put it into context or being able to "see the forest for the trees," so to speak. This issue is not uncommon even if a professor closely follows the contents of a book. At the beginning of each course I provide a list of topics that will be covered during the course in a document that I add information to as the course progresses. When we cover each topic, there are three important aspects I typically highlight. First comes the definition, then implementing the method, and finally, why we care about the subject (i.e., what its practical application is). Organizing an outline before teaching any methods, and intermittently filling in details gives students a chance to absorb some understanding of the need for the course and helps quantify what they are doing in a concise manner. Particularly, I categorize problems and methods into groups in accordance with certain common features in the method of attack. This helps students to recognize those similarities in ostensibly different problems that make them amenable to similar solution strategies. Further, it brings relevance to the theory because students learn that not every problem needs to be solved independently, but rather we have developed this general theory that can be applied to a whole class of problems.

In my discussion sections, I attempt to establish student confidence early on. I spend a little time getting to know the students by having them introduce themselves. Next I pose questions that they answer on notecards for the purpose of gaining more knowledge about them without the pressure of their surrounding peers. I then convey the language of the material to them using examples which begin simple and gradually increase in difficulty. For students having recently spoken in front of the class this provides an easy segue to continue talking casually, albeit this time about math. I ask frequent questions that provoke inquiry, motivate the approach, and at times transform their attitudes about mathematics. The lecture is purposefully designed not to reveal the full picture, thereby inviting questions and dialogue with the students. This technique makes the material more intriguing while developing healthy suspicion and intuition.

Obtaining the Graduate Certificate in College Teaching has opened the door to new techniques. Following a review with the material from the course, Teaching and Learning in Higher Education, I had a discussion with a colleague that led to a useful teaching strategy. Mathematics classes often begin a new topic with a simple example. In this new tactic, I instead assign this example as a part of the homework

before coming to class. This assignment is relatively small, composed of one or two problems that typically require no more than ten minutes to complete. In general, students find the easy problems manageable when learning a new topic, but struggle with the challenging questions. With this strategy students come to class better prepared to comprehend the lecture topic, and in turn, class can then be used to discuss the challenging questions! This is made possible by the extra minutes that are freed up during lecture. My hope is that the additional interaction helps students gain a greater appreciation for mathematics, possibly giving rise to further pursuit of the subject.

Raising standards is an important component of my teaching habits. One such strategy for me is announcing on the first day of class that at this institution the average grade is a low B. I then state that my intention is to raise the average for this class by a full letter grade, and provide other goals to make my expectations clear. Another approach I use to help raise the standard is a partnered ten minute exercise given at the end of the discussion section where students work on a graded problem involving what was discussed that day. Organized group work allows students to observe the problem solving from various perspectives of their fellow students. Group work also enables students to be less inhibited to ask questions. This teaching strategy is a less controlled approach, in terms of the instructor-student relationship. When I do this I observe a shift in the balance of power towards the students. That is, the students take charge with their problems. This better equips them for success down the road.

As an applied mathematician, when the subject has a well-known application I articulate this to the students. For instance, the students of the Calculus II course I taught learned the concept of convergence and how to solve eigenvalue problems. Both of these topics are the fundamental highlights of the course and can be brought together in a single problem. Consider Google for example, when you enter a subject in the search bar there is an algorithm that searches their database for the “best” match to what you have typed in. For this process there is an eigenvalue problem that is formulated and inside of this problem is an iterative process which consists of a sequence that must converge in order for the algorithm to yield a result. All students are familiar with Google, but few would ever suspect that calculus is at the basis of a Google algorithm. Such examples that students can relate to motivate them to become engaged with the material.

During the summer of 2015 I had the pleasure of supervising a five week research study with a high school student. My student had completed Calculus I in preparation for the program. In the first two weeks of the program I gave him a compressed version of Multivariable Calculus, along with a brief introduction to differential equations. During the third week we discussed strategies for solving our problem, namely, developing a high fidelity model of sea ice for accurately predicting the drag coefficient of air and water along the ice. With this model my student successfully demonstrated that the stress on sea ice is more sensitive to the height and depth of the ice than previously thought in models before 2010. More stress on the ice implies an increased number of fractures which in turn implies an increased rate of melting. Involving youth in real world problems demonstrates to the student the utility of advanced mathematics as well as the prospects for a career in advanced mathematics.

Helping the students learn math has only been made possible because of encouragement I have received from the inspiring teachers that came before me. I simply took note of their novel methods for teaching and incorporated them into my teaching experience. While these methods have been effective, I try to remain open to new ideas and fresh techniques for communicating math, thereby, continuing to show my passion for the subject.