Teaching Philosophy

When I teach new material to my students, my primary focus is on making sure that my students not only know the material, but understand where it comes from and the rationale behind it. As part of my participation in the Rutgers math teaching group, I led a group discussion on the paper, “Benny’s Conceptions of Rules and Answers in IPI Mathematics,” which looks at a sixth grade student and the misunderstandings of math he has. The most striking thing I noted in the paper was how the student approached mathematical problems as an exercise in using arcane and arbitrary rules to create something that matches the answer key, and that many of my students share this outlook. Not only does this leave them with an incomplete understanding of what they learn, it also proves to be impossibly demanding on their memories as new material accumulates –without a connection to what they knew previously, the list of things to remember piles up fast. Worst of all, it leaves students thinking that math is a dry and bland subject, a pointless prerequisite for the courses they really want to take. I challenge this paradigm by emphasizing the underlying rationale behind what my students learn, and showing how they can be derived from previously noted material as much as possible.

For example, when I introduced the problem of finding the length of a parametric curve to my Multivariable Calculus class, I didn’t immediately write down the integral formula on the board. Instead, I led them through the approximation of a parametric curve as a series of line segments, and then noted that we could find the length of each segment using the Pythagorean theorem. Only then did I introduce the integral formula as a limit of summation. By showing how the formula arises from already understood principles, I gave it a meaning that it would lack otherwise, and ensured that my students would better remember it. In my official evaluations, my students noted that I “taught very clearly,” and one student remarked, “When answering students' questions, he always took the extra step in making sure we could tie the material back to the bigger picture.”

As another example, when teaching Calculus 2 in the summer of 2019, I was covering how to find volumes of revolution. We had previously covered finding the volume of a solid as an integral of cross-sectional areas. I began my lecture on the washer method by introducing volumes of revolution as a common type of solid, and reviewing the previously taught method in the context of solids of revolution. Later, as a problem to work on in class with small groups, I gave my students descriptions of several volumes of revolution and tasked them with expressing the volume as an integral using each of the shell and washer method. The purpose of this exercise was to emphasize that the choice of which method to use was ultimately centered around making the resulting integral more approachable.

A third example, from my current semester (Fall 2019) as TA for Calculus 2, concerns the use of trig substitution to evaluate integrals. Whenever I was talking with a student about such a problem, rather than saying something such as, “well, our denominator is $\sqrt{x^2+4}$, what substitution would we make here?” I would say something along the lines of, “the part of our integrand that’s irritating is the fact that the thing under the square root is a function squared plus a constant squared. Is there an identity along the lines of a function squared plus a constant squared equaling another function squared?” In this way, my students gained an appreciation for using an identity they already knew as a tool, rather than memorizing a technique. Such a frame of mind presents an evaluation problem as an exercise in creative problem-solving, and ultimately resulted in students doing well on the trigonometric substitution problem on the midterm.

Ultimately, emphasizing the reasoning behind the methods, rather than just the formulae, introduces students to mathematics not as a dry stack of facts, but as an interconnected structure where each part can be ascertained from what came before. At its heart, mathematics is about using root principles and reason to give ourselves a greater understanding of the systems they describe. Theoretically, an infinitely ingenious student could recreate the majority of the mathematics we teach at the undergraduate level solely from base principles – under such a paradigm, the role of the instructor is to guide students towards discovering the material as if they did it themselves. Even for students who are focusing on math solely for its applications in another field, the ability to navigate through problems using concepts over purely memorized formulas lets them apply the techniques they learn much more easily. When I teach, I strive to not just teach my students new facts, but also to enable them to realize that they know so much more than they think they know.

Teaching Responsibilities

During my time at Rutgers, I have served as both the instructor of record and the teaching assistant for a number of different courses. The list of all such courses is as follows:

Teaching Assignments

1. Summer 2016: Math 251 – Multivariable Calculus
2. Summer 2017: Math 428 – Graph Theory
3. Summer 2019: Math 152 – Calculus 2 for the Mathematical and Physical Sciences

Teaching Assistant Assignments

1. Fall 2014: Math 135 – Calculus 1
2. Spring 2015: Math 244 – Differential Equations for Engineering and Physics
3. Fall 2015: Math 251 – Multivariable Calculus
4. Spring 2016: Math 311 – Real Analysis 1
5. Fall 2017: Math 152 – Calculus 2 for the Mathematical and Physical Sciences
6. Spring 2018: Math 251 – Multivariable Calculus
7. Fall 2018: Math 244 – Differential Equations for Engineering and Physics
8. Fall 2019: Math 152 – Calculus 2 for the Mathematical and Physical Sciences

Teaching Development Activities

I have been involved with a number of teaching-related activities outside of the classroom, in an effort to improve my abilities as an instructor. I have been an active participant in the Mathematics Teaching Group, a weekly event at Rutgers where a group of graduate meet for discussions on teaching and pedagogy. These discussions have covered a wide array of subjects, such as academic integrity policies, applying inquiry-based learning via a flipped classroom, and accommodating for students with different mathematical backgrounds. During the spring of 2019, the group spent a semester on the broad subject of improving the calculus sequence at Rutgers, and understanding the underlying issues facing it. In particular, I took on the responsibility of leading one of these discussions; in particular, I chose to look at a seminal article on mathematical pedagogy, “Benny’s Conceptions of Rules and Answers in IPI Mathematics,” by S.H. Erlwanger. While the article looks specifically at a sixth grader in a program designed for primary school students, it highlights a lot of the issues that arise in a math program that singularly emphasizes solving problems with little explanation on why.