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Teaching Statement

One key to my teaching philosophy is to find and emphasize skills that can be learned in a mathematics course beyond the specific content of the class. Such skills include choosing the best way to solve a problem when several methods are available and being able to clearly communicate mathematical or technical ideas. These tools are useful to all students whether they are continuing on to higher math classes or are enrolled in a lower level class just to fulfill a graduation requirement.

Two major topics in Calculus 2 are techniques of integration and sequences and series. Both of these topics end in a very cumulative fashion: in the first case they are told to evaluate an integral and in the second they must determine if a series converges or not. This is difficult because students must not only successfully execute the techniques they have learned, but they must also decide which techniques are appropriate. This is where a reflective look at the material they have learned and the work they have done can be helpful. I tell them to go back and look at a problem they solved and try to explain why the technique they used was a good choice. I want them to ask themselves questions like "I determined this series converged by the limit comparison test. Why was that better than using the integral test? Why doesn’t a direct comparison work?". Reviewing their work with this in mind forces them to synthesize all of the techniques they have learned. Rather than a disjoint collection of tools, students can start to see them as a single toolbox where each technique has benefits and drawbacks.

Often when I present a problem in class where I had to choose one technique from several possibilities, a student asks if an alternate solution is acceptable. After making sure that the technique they used was valid, I emphasize that it is fine to work the problem differently than I did. While my solution may be simpler or more direct, it is not more correct. It might even be the case that the student’s method is more efficient. How the techniques from the toolbox get combined depends on how an individual thinks about and works through a problem. It is acceptable for a student to favor one method over another, as long as they understand the limitations of this technique. On the other hand, there may be a tool a student prefers not to use because they aren’t completely comfortable with it. In these cases, I tell my students they need to know which other methods they can use instead, and when the use of a certain technique cannot be avoided. I tell my students which methods I like or dislike and why, with the hope that they will reflect on how they do mathematics and through this reflection obtain a better understanding of the tools they are using.

The ability to effectively communicate mathematics is particularly important for students who are taking proof-based classes, but it is also an important trait to instill in students taking classes in or below the calculus sequence. A common justification for requiring math courses of all students is to teach students to think logically in order to solve a problem. But being able to follow a rigidly specified set of rules or to apply a formula is not good evidence of this. However, communicating clearly the steps taken to solve a problem does exemplify logical reasoning. This includes using complete sentences, or at least words, to explain the validity of an argument, like why the Squeeze Theorem can be used to show a limit exists or why a certain convergence test applies to a given series. An even simpler example is using the equals sign to say that two
expressions are the same, not as an all-purpose connector between various steps in their work.

In all of my discussion sections there are weekly quizzes and afterwards I post thorough, typed up solutions on my website. These solutions contain the answers to each question as well as the accompanying work explained in a way comparable to how I would explain it to a student in-person. The solutions are more in-depth than I expect from my students, but it is important for me to show them that an ideal solution is more than a smattering of mathematical expressions. It should be a coherent, logical argument explaining how you arrive at the final conclusion.

The ability to clearly explain the mathematical content of a course is only part of what makes a teacher effective. A math class should also help students improve the way they think about and communicate mathematical ideas. These skills are useful in further math classes, where it is not necessary to have memorized the quadratic formula, but standard techniques of proof have to be combined creatively to prove a result. Beyond the classroom, the ability to make a rational argument is useful in any career students may have, whether it involves mathematics or not. I emphasize the utility of such skills in my teaching so, even though interest in mathematics will vary, my students will find value in the courses I teach.