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Teaching Statement

I have taught in a range of institutions, and my students have come from a wide variety of backgrounds. I have customized my approach to meet the specific needs of my students, course, and institution. In each case, my goal is to help my students develop their mathematical maturity, practice reasoning carefully, and to master the subject at hand. Perhaps the best way to get a sense of my teaching style is to see what this has looked like in four different types of classes.

Calculus I for the Sciences at the Waterbury branch campus of the University of Connecticut: Because of the students' wide range of majors and because of their diverse educational backgrounds, much care has been required in finding material where "the strong may have something to strive after," but that will not overwhelm the weaker students.

Related rates problems are an excellent place to achieve this balance. There is enough variety to require creativity, and there is enough regularity to allow mastery. To help students learn to create a good technical sketch, I found a nice discussion of sketching in a book on user interface design. This book breaks the "sketch" into four parts that line up exactly with the needs of the mathematics: the drawing, annotations, arrows, and notes. For our second day on related rates, I created a worksheet which summarized these principals of sketching as well as Polya's method of problem solving, and gave my students a chance to practice with a variety of problems.

Calculus II for Engineering at the Pennsylvania State University: To prepare students for the variety of technical problems they will face in their future classes, I emphasized a unity in the approach we took to solving a wide variety of problems. The idea is that almost every "method of integration" and "series test" is a variation on a single theme: rephrase the problem again and again, using one "good idea" to see how we can move the problem forward, and another "good idea" to see the goal that we are working toward. Changing the problem only changes the "good ideas" needed.

Mathematics for General Education at the University of Notre Dame: Students taking general education mathematics classes have a unique set of needs. For these classes, it is equally important that students master the material at hand and that they develop transferable skills. I have found that vivid examples keep students engaged, helping maintain the focus needed to learn the mathematics. At the same time, I have emphasized the importance of careful analysis and of showing clear and organized work, which develops the ability both to think systematically, and to communicate technical information clearly.

In the future, I plan to give the theme of "learning math to practice careful thought" an even more explicit role. For example, I think it would be valuable to frame mathematics for the liberal arts by pointing out that "every computation is an argument." By reminding students of this throughout the semester, students will learn to see that, in practicing "showing all their work," they are actually learning a type of "proof."

PreCalculus at the Waterbury branch campus of the University of Connecticut: By getting to know

my students during office hours, and by getting them to participate actively in class, I have been able to learn what they know, what they don't, and how they've been taught before. This has helped me focus in on any points of confusion, and has helped me to clearly communicate any changes in how they should approach about the material.

I have also suggested to my students that they think of mathematics as a conversation between them, the page, and their knowledge of the topic at hand. This is particularly important for weak students, because they can easily become overwhelmed and confused during longer problems. By learning to see the story in the problem they are solving, students have a better chance both of figuring out the next step and of keeping track of what they've already done.

Although each class is different, there are also many commonalities between teaching mathematics classes. In preparing each class discussed above, I have drawn upon three important aspects of teaching and of learning: questions, reflection, and clear communication.

Questions are an important part of any conversation. Indeed, the ability to ask good questions is an essential part of understanding and doing mathematics. For example, students often ask "what can I do when I get stuck?" I often say "try asking a question." And if they don't know what to ask? I try to ask them a natural, related question! Office hours and in class worksheets are an ideal place for this, giving me an opportunity to help students find the right questions to ask about problems that they have already been working on.

Ultimately, it is the responsibility of a student to master the material by reflecting on it. Regular homework, periodic quizzes, and occasional exams are an important part of this process. In most of my classes, I assign both online homework, and regular quizzes. The online homework has the great benefit of giving students immediate feedback. By giving them multiple chances to find the correct answer, online homework gives students a opportunity to correct their own errors and misunderstandings. This is complemented by the written quizzes, which gives them an irreplaceable opportunity to practice communicating mathematics clearly and correctly.

Exams also play an important role in learning and reflecting. Mathematics is much more than a collection of examples and computations. Because it asks students to reflect on the whole arc of the class, exam review has the potential to help students see the big ideas that tie all the individual topics together. I work to design exams that reward true mastery of the material. Indeed, I believe that students will learn the material best, and remember it the longest, if there is a harmony between class, homework, and exams.

Students also learn the best, and remember the longest, if they are thinking and communicating clearly. Because of this, I emphasize clear communication in all of my mathematics classes. There are many sides to this, but the first two things for students to master are thinking mathematics in full sentences and writing these thoughts in a clear and organized way.

I model this clarity of communication during class, and I encourage my students to pursue clarity both during office hours and in my grading. My students have noticed this. One Calculus II student wrote "The best thing are the notes we take in class because Professor Flood is very organized with his notes. He writes out things in full sentences which I thought was strange at the beginning of a math class, but I've found it very helpful!"

My role as a teacher is to help my students develop mathematical maturity, practice reasoning carefully, and to master the current material. I adjust my teaching approach based on my students and the specific class. And I have found that questions, reflection, and clear communication provide a robust toolkit for teaching and learning.