Teaching Statement

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For me, teaching is an activity of passion–more specifically an activity of displaying and attempting to instill passion. As a graduate student at the University of Oregon I have enjoyed the opportunity to be the sole instructor for several undergraduate courses each year. In fact, the chance to teach my own classes was one of the major attractions of the mathematics program at the University of Oregon. During my years at the University of Oregon I taught thirteen courses including College Algebra, Precalculus (Trigonometry), Differential Calculus, Calculus of Sequences and Series, Differential Calculus for Business Students, and Statistics for Business Students. I was also a TA for three courses; for these courses I ran discussion sections, answered questions, wrote and administered quizzes, graded, and gave the lecture for the professor when he was out of town. I continue to enjoy teaching as much as I anticipated (actually much more, now that I am no longer intimidated). In the following I enumerate a few of the general principles that guide my teaching and my interactions with my students.

(1) *Formulas and theorems come from somewhere.*

Whenever possible I provide reasoning for why a theorem is true or a formula is correct at a level that is appropriate for the course being taught. I believe, as a general principle, that understanding why a formula is true makes it easier to remember. Sometimes it is only possible to say, "You would prove this in Math 315." At other times I am able to give a complete or partial proof. However, a formal proof is not always convincing for some students. Another method I use to provide insight about why a fact is true is to have the students do an exploratory exercise. One example of this is to have students compute $(f \cdot g)'$ and $f' \cdot g'$ for several functions to see that the naive version of the product rule is false. I then have them compute $f'g + fg'$ and see they get the right answer.

(2) *Mathematics is a way of thinking about how to solve problems.*

One goal I have for all of my classes is to improve my students' logical thinking and problem solving skills. To this end, I try to make problem-solving techniques transparent. That is, instead of just presenting the solution, I step through the process, saying out loud the things I would be thinking if I didn't know how to solve the problem, such as, "Lets see, how do I find the instantaneous velocity again? Oh yes the derivative tells me about rates of change."

When solving story problems, I step through the process in a uniform way each time, thus demonstrating a method that students can use on other types of problems as well. I distribute a handout that outlines the process I use. Then, I use that process consistently throughout the course. For example, after reading the problem, I ask the students to formulate what we want to find out. Next, I ask them what we know. At first, many students only give the information stated in the problem, but I prompt them to include other facts as well, such as a formula they know. This is an important step in critical thinking, namely the ability to remember previous information which is relevant to the task at hand.

Sometimes the necessary previous information is only a few pages away and so another way I try to make the process transparent is by pointing out that looking through the section for a formula or theorem to solve the problem at hand is important. Many of my students have not yet had much experience with solving problems using techniques other than bare hands. When faced with a problem such as "Find the remainder when $P(x) = x^{58} - 7x + 2$ is divided by $x - 1$," they are baffled until guided to employ the theorem that the remainder can be found by computing $P(1)$. At this point the students often ask incredulously, "That's it?" which gives me the opportunity to reemphasize that theorems are labor saving devices.

(3) *Math phobia is curable.*

People who are afraid of math are my specialty. In the first week of my lower level classes, I distribute a handout about combating math phobia. It includes general advice on learning math and facing fear, from little things like not drinking orange juice the day of the test (because of the acid) to big things like forbidding negative self talk. The handout also extends an invitation to come and talk to me about their fears, which has the effect of opening a dialog with students who struggle with math phobia. This gives me a chance early in the term to influence study habits, allay fears, and encourage attendance in office hours. The handout and the surrounding conversation establish early on that I am approachable and easy to ask questions of. Some students also express fears about "cold calling" in class, which I assure them that I avoid except in a generalized form such as requiring someone wearing green or in the back half of the room to answer, a technique I use when only the usual suspects have been responding.

(4) *It is possible to interest students in a math lecture.*

I use three main techniques to interest students. I lecture in a very energetic style, mix lecturing with group activities, and highlight applications.

My active teaching style includes occasionally standing on chairs (to reach the top of the board) and kinetic learning such as instilling an intuitive sense of radian measure by making the students stand up and hold their arms at angles of $0, \pi/6, \pi/4 \ldots$ radians. Because I am energetic and enthusiastic, I have no trouble convincing students that I think math is interesting, and have in this manner convinced students to be interested as well.

Although homework provides an opportunity to actively engage with the material, in class group work allows students to try out a new idea with classmates or myself near by to help them through the initial snags. Sometimes the group activity is simple, such as drawing a few graphs and then presenting them to the class, so we can all draw conclusions about a pattern together, but sometimes it is more elaborate. To teach about tangent lines and secant lines in calculus, I present a worksheet which alternates explanations with opportunities for the students to draw pictures, sketch graphs, and compute limits, then culminates in a one page excerpt from a book explaining, in terms of traffic cops, why we need the concept of instantaneous speed, not just average speed.

Many students, cynically or not, want to know what math is good for in the "real world." In every class I discuss the standard applications such as extreme value problems in differential calculus. When I have the opportunity I also try to point out connections to social and political issues. One example of this occurs while studying exponential growth and decay, I always do a half-life problem and point out that this is why the debate about the disposal of nuclear waste is important. I am also developing a repertoire of projects that require students to apply topics learned in class. One project asks the students to find a house they would like to buy and a loan quote and then to compute the total amount they pay to pay off the loan. Another project that I have assigned is to find someone who uses Taylor polynomials in their job and write a short essay about how they are used.

(5) *Technology has a place, but is no substitute for thinking.*

Although I maintain a web page, the main way in which I have used technology in my classes is to utilize calculators to draw graphs. Doing this allows me to discuss more examples so the students have more evidence from which to observe the general pattern. For example, when discussing the graphs of polynomials I divide my students into groups and give each group a few functions to graph on the board for the rest of the class to see. This allows the students to rapidly see for themselves that all even degree monomials have a similar shape, and also that the long term behavior of a polynomial is similar to that of its highest degree term.

I have also found the statistical features of the calculator to be useful while teaching Statistics for Business Students. However, I only taught my students how to use these features halfway through the course to allow certain ideas an opportunity to take root in the brain, such as the fact that the margin of error of a confidence interval decreases as the sample size increases.

Finally, I find it is unfortunately true that the calculator serves the function of a security blanket for many students. For this reason I usually let the students use their calculators on tests and weekly quizzes, even though I also try to write some questions on which their calculator will not help. However, when it is necessary, I will give a quiz or a part of a test on which no calculators are allowed, in order to be assured that their responses are coming out of their brain and are not unduly propped up by the calculator.

I am looking forward to continuing my teaching career, especially to broadening the types of classes I teach. I fully expect that my teaching will continue to develop as I am faced with the different sets of challenges inherent in upper division classes. In particular, I would enjoy teaching an introductory real analysis course or a dynamical systems course occasionally along with the usual curriculum. I also hope to someday teach a class combining mathematical biographies and fiction about mathematicians. Finally, I have fond memories of the research projects I did as an undergraduate, and hope to return the favor to the next generation by guiding undergraduate researchers. Whether teaching myriad courses or guiding students in their research, I look forward to continuing to instill excitement, while banishing fear and making students think critically.