Teaching Statement

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Mathematics is a very old and important part of human culture. We find its origins in human attempts to quantify the laws of nature. It is tempting to think of modern mathematics as a cult of truth, founded by Isaac Newton three hundred years ago. Whatever your views on this subject, it is easy to recognize some of its features: abstractness, precision, rigor, the indisputable character of its conclusions, and finally, the exceptionally broad range of its applications. Regardless of their academic major, most students in the U.S. must take courses in mathematics over the course of their academic career.

I began teaching mathematics in 1996 as a teaching assistant at the University of Toledo. I embraced my new duties enthusiastically and responsibly. With no formal training or experience at the time, my practice was mostly based on pedagogical theories I had studied as a student and on teaching habits I had observed in my own professors. As a student, I viewed mathematics in much the same way as did my idol of the time, Bertrand Russell: *"The true spirit of delight, the exaltation, the sense of being more than Man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry. What is best in mathematics deserves not merely to be learned as a task but to be assimilated as a part of daily thought, and brought again and again before the mind with ever-renewed encouragement."*

I tried to find the best examples, the clearest proofs, and the most intriguing aspects of the subject to present to my students. I was admirably well-prepared and organized.

Much to my surprise, a few weeks into a semester, I found that my students did not share my view of what a great job I was doing. One of my students expressed his views rather forthrightly, as follows: *"Prof. Punoševac seemed to assume that math is a perfectly natural affair for most anyone, whereas I barely even knew what numbers were. I just wanted to get through the class and get a passing grade! And now, I'll be lucky if I ever graduate".*

Since then, I have undergone teacher training on two occasions, once at the University of Toledo, and the second time at the University of Arizona. My teaching philosophy has evolved radically with cumulative experience and reflection.

In spite of my rigorous preparations for the classes I was teaching, my original approach to teaching mathematics had been based on a few wrong suppositions. The first one was that I would be teaching students who already had an interest in the subject. The second one was that I would be addressing an audience of future professionals, or at least serious learners who plan to use the subject in their future professional work. Nothing could be further from the truth. The bulk of undergraduates taking mathematics at a typical U.S. university are students who will be making limited use of mathematics in their lives, and who are ill-prepared to take the course in the first place. Consequently, this calls for a radical departure from the rigid type of teaching philosophies. Knowing your students is the first and often the most important step in teaching them effectively and successfully.

Teaching an advanced undergraduate or graduate course has a dual purpose. On the one hand, there is a certain body of advanced material to be presented and learned by the members of the audience. The students should be able to reproduce the proofs and apply results in solving problems. On the other hand, such a course is an opportunity to teach students certain ways of thinking in mathematics where specific material is used to illustrate mathematical ideas.

My favored approach is to introduce empirical evidence first and reinforce the point of view that mathematics is a part of physics where experiments are cheap. I tend to skip even essential details at first, and try to bring students' attention to the structural and logical elements that will play key roles in the development of the particular mathematical result I am trying to present. However, as observed by Courant, empirical evidence alone can never establish mathematical existence of real world phenomena. Only a mathematical existence proof can ensure that the mathematical description of a physical phenomenon is meaningful. Therefore, I follow up by providing rigorous mathematical proofs. I do not like using the most elegant arguments, but prefer instead the arguments that will be most instrumental in exposing the key ideas of the proof. I am not a fan of well-polished results typically found in good textbooks. I prefer to dissect statements of theorems to the simplest and the most specific cases in such a way that no further simplifications are possible, while still preserving the content of the original mathematical assertions. I love to reveal the motivation that led to the discovery and supply computational examples whenever possible. I am a fan of the guided discovery method, better known as the Socratic method.

Many low level undergraduate or remedial courses seem to lack purpose. The books are often poorly written, emphasizing "facts" and superficial reasoning, which will supposedly prepare students for sequential mathematics courses, even though many of these students may have entered the classroom, having already decided that this will be their final college (or even lifetime) encounter with mathematics. Students understandably often perceive the content of those courses as detached from reality and utterly useless. On top of it all, many students enrolled in these courses have had long gaps from any previous mathematical coursework.

In such a situation, a clearly outlined set of attainable objectives is a much more appropriate than some big, hard to reach goals. In my opinion, the only way to learn mathematics is by doing it, and students must take an active role during and after class periods in order for any meaningful transfer of knowledge to take place. I expect students to read, think, and disseminate ideas appropriate for their learning level, as well as work on problems beyond automated reproduction of algorithmic steps previously seen. I tend to put emphasis on ideas or concepts most likely to be encountered in everyday life. I like to steer away from any memorization and blind repetition. Even with all that in mind, many students taking these courses will have a very hard time and will have to struggle to succeed. When the audience's knowledge is limited, even a single key term used without an explanation may irreversibly leave behind many people in the audience. The rate of absorption of new material is finite. If students have little or no background knowledge, even well-presented material, may at the end be incomprehensible if too much is packed into too little time. Therefore, I constantly monitor comprehension and adjust the tempo of my presentation accordingly.

I love to use information technology in teaching. However, one has to be very careful with it, as it is all too easy to introduce another layer of unnecessary complexity in the learning process by careless use of digital computational devices.

I do believe that different people learn in different ways. Consequently it is crucial to remain adaptable and responsive to the needs of the students.