Teaching Philosophy

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Most members of the public think that mathematics is an overly complicated, arcane subject; when people find out that I'm a mathematician, our conversation usually ends abruptly with them saying, "I never really got math." They are not wrong to think that math can be challenging, but the subtext of such statements is often, "I have no ability to do math" which is simply not true. Because of this attitude and my strong desire to share how rewarding mathematics can be with others, the characteristics that I strive for most in my teaching are clarity and accessibility.

To me, this means communicating clear expectations to my students about which concepts are important and making sure my teaching conveys what makes those concepts work. On a global level, this involves recapping at various points throughout the semester how those concepts fit together. On a local level, when working through individual problems for and with students at a chalkboard, this means that we work slowly through the problem, pausing frequently to make sure everything is making sense, and using bullet points or numbering the lines of an equation to summarize and drive home the key steps at the end.

I've been able to fine tune my teaching over 10 semesters at the University of Illinois leading active learning discussion sections with a diverse undergraduate student body consisting of a substantial international population as well as students with different backgrounds from the suburbs of Chicago to rural Illinois. I have also taught 4 semesters at Syracuse University, where I was the instructor of record for 3 semesters. During that time, I have come to fully appreciate that there are many different styles of learning so that an explanation which works well for one student may not work as well for another. When working one-on-one or with a small group of students, I will tell them, "It's okay to say you don't understand; that just means I need to try to explain things a little differently."

In order for this to be effective, it is important that I develop a good rapport with my students so that they feel comfortable speaking up when they don't understand something. I start this process every semester by memorizing the names of all of my students within the first couple weeks of the course in an effort to communicate to them that I know who they are and am very much invested in them learning the material I am teaching. In this respect, I have been fortunate enough in my years of teaching to have been responsible for not much more than sixty students per semester so that this is feasible. This small act has a surprising impact on class atmosphere. Research by Claudia Mueller and Carol Dweck shows that even small modifications in how we interact with students can affect their performance; for example, praising students for their hard work as opposed to simply being "smart" can improve student willingness to persevere in the face of adversity. This is something I try to keep in mind in choosing my own words while engaging with students who are struggling to learn.

This attention to linguistic detail is actually a theme in my teaching, because I very much approach the finer points of teaching mathematics as if I were teaching a foreign language. My goal is to produce students who are mathematically literate (within the scope of the course that I am teaching), who can correctly parse the problems that are put before them and can also write down their math in a way that is well-organized and easily understandable for others – myself, their classmates, etc. I will often ask, "How do I write this down?" or "How do I translate this from English into math?"

Part of this philosophy involves emphasizing to my students the use of correct notation and writing well-formed expressions with limit and summation signs in all the proper places. While this focus may seem slightly pedantic to my students, it is an important distinction to make because such syntactic errors can breed semantic ones. For example, while teaching second-semester calculus, I will frequently say to my students, "Do you mean a sequence or a series? Because if it is a series, it needs to have a summation sign in front of it so that we know what you mean." Likewise, when I am speaking with students, I am always careful to verbally make the distinction between a series and the sequence of its terms. This point has been reinforced in my own research where finding the right notation or way of writing something down has helped shed some light on the mathematical object I was working to understand.

I also try to stress semantic differences between mathematical terminology and everyday English. Teachers of higher-level mathematics understand well the logical relationships between an "if . . . then" statement, its converse, and its contrapositive. However, I can still remember a time before my mathematical training when I did not, and many of the students that I work with have not yet internalized these distinctions. So it's worth pausing every now and again to emphasize them. This can be as simple as asking a calculus student whether a series whose sequence of terms converges to zero also converges. Pointing out common pitfalls and checking where things can go wrong is by no means a novel idea, but it is something that the best teachers in my own education did on a regular basis which I try to emulate.

In more advanced classes, I focus on teaching students how to form and write down well-reasoned arguments. I prompt them with such questions as, "Did we write down everything that we need to say? What theorem are we using? What are the hypotheses we need to check? What's the conclusion?" The ability to present evidence and state a conclusion in a coherent way is certainly an important skill that extends far beyond mathematics.

To a large extent, I believe that people learn by observing others and attempting to mimic what they observe to the best of their own abilities. And so, it is particularly important for me that all of my written and oral communication provides a good model upon which my students can build the foundations for their own work. If I have done my job clearly and effectively, not only will this help to ease the general perception of mathematics as abstruse and inaccessible, but the good organizational and reasoning skills I impart to my students will serve them well throughout their future endeavors.