TEACHING STATEMENT

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It is my belief that we learn mathematical principles most effectively by actually discovering them; observe many examples and then make analogies about repeated patterns. In fact, for the sake of clarity and elegance, most math textbooks are written in the opposite order – abstract principles and formulas followed by examples. I think a great instructor should reconstruct the process of discovering subject principles from bottom up, and guide the students to discover them by themselves. Through this way of teaching, or rather, guiding and discovering together, I hope to achieve my ultimate goal as a math instructor: to teach them mathematical way of thinking.

My philosophy in teaching mathematics stems from my personal experience as a student. I spent my middle and high school years in the highly competitive environment in South Korea. High school mathematics in Korea covers up to a typical curriculum of Calculus 2 in the US, and the focus is on solving non-trivial problems quickly without making errors. I was overwhelmed by all kinds of clever tricks and formulas to memorize. As most other students do, I though math was only for the smartest those who would easily come up with such tricks by themselves. It was during a summer in high school that I spent in a buddhist temple, that I realized that everything is written backward. The dirty part of the process of discovering mathematical principles was hidden behind the refined results.

At the Ohio State University, I have successfully instructed six undergraduate calculus courses at various levels. Here is how I usually organized my classes. At the beginning of class, I first give the students a general motivation and bigger picture of what we are going to study. For instance, I would ask them what are differentiation and integration are good for. Then I say they are both studies of unknown objects via familiar ones; curves by lines and area under curves by rectangles. Then, I present a couple of examples, which are easy and concrete enough but also contains the essence of the theorem or principle. It is important to go through them with students step by step, asking questions to lead them to take the "most natural next step". After they discover and agree on a common pattern that I intended, state the main theorem and principle in a more abstract version. At this point, students have worked out concrete examples from which they can draw analogy when looking at abstract statements. Then we work on less obvious examples, guiding students to see the abstract pattern they have discovered in different contexts. This will solidify their understanding.

Asking questions and giving examples on point are very effective in involving students in class and also in resolving their misconceptions. For instance, in a Calculus 1 class, I asked my students a limit problem of the form $\infty - \infty$. Some student said "the answer is ∞ since

the first term diverges". I asked him the value of $\lim_{x\to\infty} x - x$, and he realized what goes wrong immediately. Then another student asked, "Then is $\infty - \infty$ always zero?" So I gave her $\lim_{x\to\infty} x^2 - x = \lim_{x\to\infty} x(x-1)$. She knew the answer was ∞ obviously. Some other asked what does $\infty - \infty$ even mean. I said, "It means you need to work harder." The point here is to give students the right example so that they can figure out and correct their misconception by themselves.

Here are some examples of student's comments on my teaching:

1. Hanbaek is the best math instructor I have had. He has a knack for discern where students are going wrong conceptually and then addressing their mistake in a clear, non-aggressive way.
2. He is really funny and makes the material easier to learn. The way he teaches really helps "dumb down" the concepts, which is really helpful when the material is really hard. Lyu is really sweet and if you need help or have make something up, he would spend time out of class wanting to help.
3. At first I was a bit surprised because Hanbaek has a very different way of teaching that I am not used to. Once I figured out his teaching style I learned Exponentially.
4. The instructor did a great job at clarifying topics covered in class. Difficult principles were broken down to simple and easily understood concepts. In general, I found him more helpful than the professor.
5. Good teacher, clear in explanations, clear drawings clear representations and well written solutions to homework, made sure students knew what they are doing.

In postdoctoral and higher position, I will have students of maturity in advanced undergraduate or graduate courses. As I interact with them in class, I will adjust the balance between examples and theories. But my principle of "guiding and discovering together" will be central to my teaching style. I believe the best way to teach how to catch a fish is to help the students catching fish on their own.