TEACHING STATEMENT of Ji Li

or How I Came to "Step Into the Door" of Teaching

My Father And I

To me teaching is learning, so my philosophy of teaching is that one learns by doing. This, if not everything else that is remotely remarkable in my life, I owe to my father, who was a middle-school and high-school teacher on various subjects for thirty years, and whose insightful teaching influenced me in every daily moment that I spent with him. The following incident occurred during the summer I graduated from middle-school.

It was the first time I learned the game of *go* with my father. He started by awarding me a ``headstart'' of 9 black points, intending to play a handicapped game with me. I complained:``How am I supposed to improve if you were not playing equally?" He replied:``If you can beat me with the aid of your extra 9 points, then you will prove to have `stepped into the door' of the game of *go*." --- ``Stepping into the door of something" is a Chinese saying, meaning ``getting the hang of something". Not surprisingly, I lost the first game. However, I was so motivated by my father's comment that I tried my best to practice playing *go*, in order to achieve the then-ultimate goal of ``stepping into the door''. By the end of that summer, about two months later, I beat my father with the compensation of 9 black points. I felt very proud of myself. A lot of years passed before I realized that it was my father's motivational skill that worked the magic on me.

Teaching Algebra

There is much to say about philosophies of teaching. For me nothing is more important than to put my hands on it and to learn through trial and error. A person has limited amount of time and energy to spend on teaching, and yet for an unexperienced person there is never enough practice. Therefore it is efficient to also learn from others. The best possible scenario is to work with experienced teachers and educators and to study the class atmosphere first hand, observing the methods of delivering hard topics and handling tricky situations. I feel tremendously fortunate to have been offered the opportunity to do this.

Now I wish to offer you a story about my involvement in two different semesters of teaching the same course: algebra for primary school and middle-school teachers with pedagogy (Math 505C from The University of Arizona). The first time I taught 505C with two other teachers, one of them an established professor, the other an experienced high-school teacher. I observed these two great teachers perform, took notes of the communication between the students and the teachers, accumulated a good deal of thought-provoking questions that a lecturer can use to probe the thoughts of his or her students, and learned how efficient it is to let students explore on their own. There are many moments that are worth mentioning, here I provide just one:

The subject was the laws of exponents, and the students were given 5 minutes to come up with an argument to prove the identity $x^0 = 1$ *using other more basic laws of exponents and arithmetic rules. Two students proposed their answers on the board:*

To show	$x^0 = 1$ *for* $x \neq 0$
using the formula	$x^{n-m} = \frac{x^n}{x^m}$
as follows:	
Since	$x^0 = x^{3-3}$ *and* $x^{3-3} = \frac{x^3}{x^3}$ *and* $\frac{x^3}{x^3} = 1$
Therefore,	$x^0 = 1$

One student commented: ``Did you come up with this on your own? It's cool.'' One teacher commented: ``This was a question posed to algebra teachers and this answer was what we were looking for.'' Now the other teacher asked, "Can we do this using the sum rule (referring to $x^{n+m} = x^n \cdot x^m$*) instead?"*

The second time I taught 505C with another experienced high-school teacher in a summer, and I was trying to engage students in the same way as before, because I knew it would work. However, it did not work out just the same as before. What I learned at this time was how to take it slower than planned when students seemed confused about some basics. I also learned the art of ``giving away'', namely, when students failed to come up with the nice answers that we had planned out, there were certain moments when teachers needed to explain our way of thinking rather than waiting for students to discover every concept on their own. Mathematics classes, after all, are not meant to be 100% frustration.

Through these two times teaching the same course I realized that seeing others do a wonderful job did not necessarily mean I could succeed by mere mimicry. After all, teaching is not a process of copy and paste. A wonderful example for one teacher could be disastrous for the other if not used properly. To teach well has something to do with *Carpe Diem*: to seize the moment. Even if one had in mind a great question to ask students, it is still essential to find the right moment to do so.

Teaching Combinatorics

In many ways, teaching is like living a life, since it involves mostly tiny details. With all the good intentions to be a good teacher, the never-enough effort spent on preparing the most elaborate and perfectly organized teaching notes, the tremendous amount of time spent on office hours and review sessions, one is still always missing something, something important, something unpredictable. I must rely on my instinct, as well as my past experiences to establish more or less a systematic way of treating different types of students as well as tricky situations, so that I will catch the ball on the fly.

Next I will describe an incident at my combinatorics class (Math 447/547 from the University of Arizona) for undergraduate and graduate students. Combinatorics is my research area, and I feel strongly that I need to deliver my own understanding of the subject and to demonstrate to the students how exciting the topic is. However, for a variety of students in terms of levels of their mathematical knowledge, I had to take special caution to lay a good foundation.

I adopted the game of mastermind (see [1]) as an incentive for students to be exposed to pure logical reasoning. During one of the first classes I asked a question ``How many outcomes can a master mind game have?''. Within a minute, a student answered ``13'', and I asked, ``How did you come up with this answer?'' To which he replied with a neat bijection using distribution numbers. I realized instantly that this was a brilliant student who possessed the very fundamental idea of combinatorics: the bijective reasoning. On the other hand, his answer was way too advanced for the class. For one thing, the topic of the distribution numbers, which are the binomial coefficients that give the numbers of ways to distribute n distinct or identical objects into k distinct or identical boxes, would be fully discussed in the next chapter, and most students seemed lost when listening to his explanation. Hence I nodded to him, ``Great job,'' and proceeded to others, ``Any other suggestions on how to solve this problem?'' I did not waste precious class time on going over his argument at that time, although I did mention this example later when the topics were covered. The same student performed extraordinarily later on trying every extra-hard optional homework problems that nobody else was doing, and I encouraged his effort in my own ways: I gave detailed personal comments on all of his work.

Keeping it in the Learning Zone

Tolstoy said, ``Some people are called poets because they write poems, and some people write poems because they are born poets.'' On teaching, I believe I belong to the first group. Now I feel like I may have finally ``stepped into the door'' of teaching, and if anything, this would be just a beginning of getting into the world of teaching further, which is going to be harder than ever, since it takes more effort just to prevent oneself from slipping out, which is, indeed, a much easier thing to do. Yes, that I had learned, long ago. I started high-school after that summer when I learned *go* from my father. In the winter I came back, having not practiced *go* throughout the semester, and lost to him hopelessly, with compensation of 9 points. I have never played *go* ever since. However, the same thing will not happen to my teaching, because I have many questions about teaching yet to be asked and answered.

References

[1] Tucker, A., ``Applied Combinatorics'', 5th edition, Wiley, John & Sons, NJ, 2006.