Teaching Statement

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I am at heart a teacher. Sharing my knowledge and understanding with others has always been a source of joy for me, and my greatest satisfaction comes from watching people learn and grow. My desire to teach has been there for as long as I can remember, manifesting in the form of being enthusiastic about teaching basic math to young kids in my village, to "teaching" my classmates the subject at hand before homework sessions and exams. Even at that small scale, it was always gratifying to see people's "aha moments", particularly because they reminded me of my own aha moments.

My graduate school experience added more depth and variety to my teaching. Doing research helped me appreciate the intricacies of the subjects, which made my teaching more effective. The process of teaching a variety of courses (both lecturing and being teaching assistant) for several semesters helped me appreciate even more how much I learn by teaching. Interacting with many inspiring and enthusiastic teachers helped me clearly see my own passion for teaching. And a graduate level seminar course with inquiry-based teaching component in Cornell's Education Department—Innovative Teaching in the Sciences—pleasantly surprised me by introducing me to several effective teaching techniques, many of which I had been using without even being aware of them.

These experiences have helped enhance my understanding of teaching and to some extent solidify my manner of teaching. In particular, I believe that **(1)** teaching is not *imparting knowledge* to students, but rather is a *collaborative learning effort* between a teacher and students, **(2)** the foremost purpose of teaching is *to empower students* and *equip them with skills*, **(3)** teaching is best done by *relating new concepts* to what students already know, and **(4)** teaching methods ought to be *adapted to the needs* of the situation.

(1) Teaching as a process of mutual learning In my experience, teaching has always been fertile ground for *mutual learning*, a two-way street of sorts, which continually refreshes my motivation to teach. On one hand, it is inspiring to watch students progress and grow, and, on the other, it is inspiring to know that the whole teaching process, from preparing lectures, interacting with students and listening to their ideas and questions, to designing thoughtful problem-sets helps deepen my own understanding of the subject.

This realization about mutual learning motivates me to keep students at the center of the instruction. I encourage them to *ask questions*, by repeating the importance of questions, and by creating a friendly environment where they are at ease with me and with each other. This helps students understand the material better than passive instruction, and helps me learn what parts of the instruction need more focus and attention.

One concrete method I use to keep students at the center in teaching of computer science is by "constructing a proof/algorithm" with the students rather than immediately "telling them the right answer". When there is a choice of the next step in a proof/algorithm, I typically ask students what they think is a natural way to proceed; I see students getting enthusiastic, encouraged and involved in the process, particularly during my office hours and one-on-one time. This is not always easy though: I am sometimes unsure myself whether an unknown idea will be fruitful. As a result, we sometimes end up exploring "wrong" branches just to appreciate the "right" one, but this helps students learn about the process of constructing a proof. They also learn, as an important byproduct, that I am not someone who knows everything about the subject at hand, but that I am just someone who has more experience with it and who is willing to guide them in their inquiry and learning. And this makes the process of learning more collaborative and more fun.

(2) Teaching to empower and equip One of the most crucial purposes of education, in my opinion, is to empower and equip ourselves: to learn that we are storehouses of unique and immense capability (empower ourselves), and to learn ways to realize that potential (equip ourselves). My most important job as a teacher, then, is to ignite students' curiosity to help them learn what interests them, to help them learn their strengths (and weaknesses) and learn skills so that they can follow their passion, and most importantly to impart them the love of learning.

To empower students to face the challenges ahead—challenges we haven't even imagined yet—we also need to look at situations that arise outside of the classroom, and what common patterns emerge in facing them. Most challenges that we face require (a) *group effort*, not just individual effort, (b) good *communication* skills, and (c) the spirit of group members *educating and helping each other*, all of which help make the whole bigger than the sum of its parts. I encourage students to discuss study material together and collaborate on homeworks to brainstorm ideas. It helps them appreciate the importance of group effort, as it gives them opportunities to help each other. Once students have intuition about the solution, I ask them to write their own solutions individually. This process helps them formalize their intuition and helps them learn to clearly communicate, a skill that goes well beyond classroom.

(3) Teaching the constructivist's way The process of learning described above, where students actively participate, is reminiscent of the constructivist approach. This approach makes a somewhat intuitive claim that students don't just discard all they know in order to learn the new material from scratch, but rather incorporate the new knowledge into their web of existing knowledge.

To facilitate students' learning in this manner, I use the following two approaches. First, while presenting an algorithm or protocol, I like to go *from concrete to abstract*. It is much easier and effective for students to see a run on sample input (for example, run breadth first search on a simple graph), or to see a simpler version of the algorithm, and then to generalize it (for example, show an algorithm on trees, and then generalize to graphs). Second, I like to relate the subject material to their everyday experience (for example, relating shortest path in a graph to driving routes on a map), and luckily, for something as pervasive as computers and mathematics, the examples are plentiful.

(4) Teaching that adapts I believe that it is very important for a teaching method to be *self-correcting* and *adaptive*, and *genuine feedback* can really help make it so. Therefore, I make every effort to exchange genuine feedback with students in a friendly and open environment.

I solicit feedback in many ways, ranging from something as informal as stopping a few times in a lecture and assessing how much students are following, to something as formal as asking for written evaluations a few times a semester, instead of just at the end.

I love making problems that require students to apply concepts rather than just reproduce them. I like giving exams that don't require rote learning (for example, open-book and take-home exams). I like to reward students for their hard work and understanding of the subject, rather than just for the "correct answers". Through these assessment methods, students learn how much they genuinely understand the subject, and I learn about the effectiveness of my own teaching.

However, the most important interaction mediums for me are: regular *one-on-one* time for individual interactions, and regular *office-hours* time for small group interactions, for the simple reason that they offer so many benefits (outlined below) for making my teaching more effective.

(a) During these individual interactions, I get to listen to how students have understood the course content. This helps me become aware of the *misconceptions* that invariably creep into a large classroom, and allows me to gauge how effective the teaching has really been, which then allows me to adapt my teaching style.

(b) In my experience, these interactions are really helpful for students—especially those who fall in the vicious cycle of getting lost in the course, and then being afraid to ask questions leading to more confusion—to get over their learning difficulties.

(c) They help me cater to students' *unique needs* (for example, offering non-standard assessment methods, oral exams) and *goals* (for example, different students have different goals for the course). They also help me provide specific feedback to a student.

(d) For students who are particularly fast at learning a subject and "feel bored in the class", I use this time to expose them to more advanced material.

(e) Finally, these interactions help make the teacher-student relationship more informal, which in turn helps make the classroom environment friendly and conducive to open discussion, questions, and learning.

Conclusions I have mentioned some of the ideas that I frequently use in my teaching, but it is challenging to always execute them well, let alone to perfection. Nevertheless, I have a strong desire to keep learning from my mistakes, be open to feedback, and become a better teacher. I want to continually discuss with colleagues and students alike ways that I can improve my teaching. Although my manner of teaching currently revolves around the four core principles discussed above, these are by no means the only principles that I am willing to use. I know there are situations when these principles fail, when my preparation for the situation falls short, and when I face questions I don't know the answers to. In such situations, I particularly look forward to advice from senior teachers, professionals, and students. After all, the learning aspect of teaching is a fascinating one for me.

Courses Given my experience, I feel I am well equipped and qualified to teach any core computer science course, and any basic mathematics course (for example, linear algebra, calculus, probability, combinatorics, symbolic logic). My areas of particular strength include introductory and advanced algorithms, automata and complexity theory, discrete mathematics, (algorithmic) game theory, online and learning theory, linear programming, and graph theory, and I would like to design and teach course in these areas. But I look forward to teaching other courses as well, since that would help me deepen my own understanding of those subjects.