Teaching Statement

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I consider teaching every bit as important as conducting research, and aspire to excel on both fronts. From a basic scientific point of view, excellence in teaching is essential to the growth of any field of inquiry. From a sociological standpoint, dedicated teachers inspire and empower students to pursue their dreams and serve as role models. I see teaching as a valuable opportunity to pass my passion for theoretical computer science on to the next generation, and I find it extremely rewarding to help my students grow. Finally, teaching is inherently a two-way process. Time and again, my students have taught me new perspectives and led me to new insights. My interactions with them have made me even more excited about my research and motivated me to be a better role model for them.

My teaching goals

As a teacher, I have three ambitious goals.

1. I strive to equip my students with a solid foundation for working in our field. I work hard to help my students understand the fundamental questions in theoretical computer science and why we study them. I challenge myself to give them all the tools that they need to be successful in this exciting area.

2. I aspire to give my students ample exposure to the research frontier far beyond the textbook and help them grow into visionaries and deep thinkers. In our classroom, we will not be able to reach the deepest levels of technical sophistication on every topic. However, it is essential that we learn to push our boundaries, ask probing questions, internalize the "big picture," and understand the field's role in modern science and the real world.

3. I work hard to help my students master the art of problem solving. My students will come from a variety of backgrounds and interests, and many will go on to pursue careers far from theoretical computer science. However, the skill of problem solving is of central importance in every area.

Ultimately, I want to equip and empower my students to be lifelong learners and producers of knowledge, regardless of their chosen career path. The thought of running into a student of mine someday and learning that my course sparked their passion for theoretical computer science, or gave them the tools to succeed in any other field of their choice, fills me with excitement that I find impossible to put into words.

My teaching strategies

To accomplish my aforementioned goals, I use several pedagogical strategies. The list below is by no means exhaustive but forms a foundation for my teaching. The first four strategies focus on the delivery of course material in class. The fifth and sixth strategies take aim at student engagement and active learning. The last strategy focuses on the learning that takes place after class.

1. Provide context and motivation. When abstract definitions or theorems are first introduced, it is usually not immediately obvious how these concepts are going to be useful. Unless they are properly motivated, it is easy for students to lose interest. Therefore, I am always careful to provide context and motivation. For example, when students first encounter the all-important complexity class known as the *polynomial hierarchy*, they tend to wonder how such a thing could be useful. I take this opportunity to explain that the polynomial hierarchy is historically inspired by the arithmetic hierarchy, interpolates between the more familiar classes NP and PSPACE, and arises naturally as the result of giving Turing machines access to an *oracle.*

2. Be clear and precise. A lecture should be clear, definitive, and precise. If the instructor gets sloppy, many students will follow suit. Others will get confused, struggle with the new material, or even lose interest. I take great care to avoid such outcomes. I am especially careful to provide an abundance of concrete examples. Other powerful tools that greatly enhance a lecture's clarity are color markers and diagrams. Apart from being clear and precise, a good lecture needs to be engaging and memorable to stimulate the students' interest.

3. Pause regularly. To communicate ideas effectively, a lecture needs to be properly paced. I pause regularly during my lectures to give the students time to absorb the material and, ideally, try to guess the next step on their own. I also pause at the end of proofs to gauge the students' understanding and take questions.

4. Look back. After covering a theorem or an algorithm, I take the opportunity to look back at the proof with my students and reevaluate it. Can the proof be simplified? Are all the hypotheses necessary? Could our proof strategy be useful on other problems? Reflecting on a proof in this way helps students truly internalize the material, discover its connections to other concepts that we cover, and ultimately develop a deeper appreciation for the subject.

5. Interact with the students. My teaching style is highly interactive. I maintain constant eye contact with my audience to read their reactions, adjust my pace, and provide additional clarifications if necessary. I encourage my students to share their thoughts and be active learners. In my experience, active student involvement greatly enhances pedagogical outcomes and boosts the students' enjoyment of the learning process.

6. Ask questions, and take questions. I often pause to ask questions of the students and to answer theirs. Questions during lecture are a part of the previous item on interactive teaching, but their importance is so great that I list this as an item in its own right. Asking the right questions is key to being a successful problem solver, and I work hard to help my students cultivate this skill. When faced with a new problem, a seasoned researcher asks a variety of questions. To begin with, which of our previously mastered methods and notions are relevant? How can we simplify the problem at hand? Can we break the problem up into easier subproblems? Are there key special cases to study? During my lectures, I ask such questions frequently and emphasize their power in discovering new knowledge. I invite my students to do likewise and to truly take ownership of their learning.

7. Assign homework and be ready to help. The only path to the mastery of any skill is practice. I find it helpful to give my students a homework assignment at the end of each lecture, to help them internalize the new material and connect it with what they already know. I will make sure there are abundant opportunities for my students to get help when they need it, in the form of in-person office hours and easily accessible lecture materials. Rather than tell the students the solution right away, I will guide them on the path to discovery with hints and suggestions. Through my personal interactions with the students, I will strive to forge a supportive, nurturing learning environment where everyone feels empowered to succeed.