KRISTEN GARDNER  STATEMENT OF TEACHING PHILOSOPHY

To me, the central purpose of higher education is to help students build a conceptual toolbox that they will apply confidently to their work now and in the future. While it is important for students to acquire knowledge specific to their chosen field of study, I believe the most valuable lessons are those that teach students how to approach unfamiliar problems. As technology-based approaches become increasingly ubiquitous in addressing problems across all disciplines, it is important for future leaders to be conversant in computing. My role as a teacher is to facilitate my students’ understanding of principles that they will apply to challenges they encounter beyond my classroom. I believe that students achieve a deep understanding of analytical methods when they develop these techniques largely on their own, and I use this principle of “learning by doing” as a guide for how I structure all aspects of my teaching.

Classroom Instruction

In the classroom, I implement an interactive teaching approach by structuring my lessons as guided lectures, keeping my students constantly engaged throughout the class. In my 90-minute recitation sections with 20 students, I distribute worksheets with questions that guide students through the lesson, breaking up a difficult concept into smaller, more manageable pieces. I alternate between giving the students time to answer the questions on their own or in small groups and discussing the solutions as a class. While the students work independently, I circulate around the room to assess their understanding and to determine the concepts that I most need to emphasize when we return to the lecture. This approach helps students feel comfortable participating in class because the worksheets are designed to prepare them for the questions I will ask in the upcoming portion of the lesson. Even when I deliver more standard lectures, I keep my lessons interactive by asking my students questions to check their understanding. I often end class with a short quiz that highlights a key concept covered in the lesson; this enables both my students and me to quickly identify and clarify any points of confusion. My goal is for my students to be mentally active while they are in class.

I encourage my students to come to office hours, where talking to them in depth enables me to better understand their learning styles and difficulties, and to tailor my approach to their individual needs. When aiding students with homework, I rarely answer a question outright. Instead, I break the problem down into small questions that guide the student towards a successful approach. I often ask students to re-teach me their method of solving a problem to reinforce their understanding. I hold office hours twice a week and by appointment, and when more students attend than I can easily accommodate, I encourage them to discuss their questions with each other while they wait for my individual attention. Often, students answer their own questions either partially or completely by explaining concepts to their peers. For students who have mastered the material taught in class, office hours offer a valuable opportunity for me to push them to think beyond the course content. In an introductory course, I might ask a student who has a clear understanding of arrays to think about how she would approach sorting. In an upper-level seminar, I might encourage an advanced student to think about open research problems.

My philosophy of “learning by doing” extends to written assignments such as homework and exams. I believe that homework is most valuable when it extends and enriches the content introduced in class, for example, by reinforcing a proof technique, by generalizing a theorem, or by providing examples of how the course content applies in a broad range of contexts. For example, I might design an exercise about Bayes’ Law in which students compute the likelihood of various presidential election outcomes given information about the accuracy of polling data. Offering varied examples of how analytic tools can be used both within and outside of computer science makes the course content more relatable and exciting to students with diverse interests.
Research Mentoring

I believe that the best way to excite students about research is to motivate a project with a broad question that ties the research goal to the student’s experiences, such as “how can we get web pages to load faster?” Answering this type of question involves both theoretical components (e.g., developing system models, mathematically analyzing performance) and practical components (e.g., collecting empirical measurements, simulating proposed solutions, and implementing these solutions in real systems). My preference is to simultaneously supervise multiple interrelated student research projects that use different approaches to address pieces of the same high-level question. For example, a mathematically inclined senior thesis student could work on identifying optimal scheduling policies for systems such as web servers in which jobs consist of multiple subtasks. At the same time, a systems student could work on building a web server that implements several alternative policies to compare their performance. I strongly believe in the value of collaboration. Many of my most successful research ideas arise from working closely with my mentors and peers. Through working on complementary projects, my students will gain the opportunity to use one another’s insights to inform their own approaches, as well as to see how each individual component fits within a larger research goal.

I view research mentoring as an extension of teaching, and I am eager to work with student researchers from all class years and with diverse experience levels and skill sets. When I begin working with a student, I will propose a well-defined project and suggest specific possible approaches. As a student gains experience, I will guide him or her towards independently identifying new research problems and solutions. Throughout my time working with a student, whether for a summer, a semester, or several years, I will hold weekly meetings to discuss the student’s ideas, successes, and failures. I believe that part becoming a successful researcher is learning to communicate clearly and effectively. Through presenting their ideas both to me and to their peers, students will hone their ability to communicate technically.

Future Teaching Goals

Teaching has been one of my most gratifying experiences as a graduate student at Carnegie Mellon, and my enthusiasm for teaching has led me to pursue a career teaching and mentoring undergraduate students. I find it immensely rewarding to incite interest and excitement in students for topics about which I am passionate. As a faculty member, I will contribute to existing courses in both theory and systems and create new electives that provide a foundation in performance modeling. In particular, I will develop 200-level courses (e.g., Probability in Computing) that introduce elementary probability concepts and use probability to help students form intuitions about algorithm and system design, as well as upper-level special topics seminars (e.g., Analytical Performance Modeling) that delve more deeply into the mathematical foundations of performance modeling. These courses would appeal to students seeking to become mathematically prepared to apply to graduate school in computer science, as well as to applications-driven students who hope to learn how modeling can provide solutions to real-world problems. My courses will help students hone the analytical and critical thinking skills they need to approach new problems both within and outside of computer science, and will complement current course offerings within the department.