David E. Irwin

Teaching Statement

I consider being a teacher and mentor both a great privilege and a serious responsibility. Teachers are in an unique position to influence and shape their students' lives for the better. To this end, my teaching and mentoring philosophy has three underlying goals: 1) to excite students about the topics I cover, 2) to inspire them to pursue those topics beyond the classroom, and 3) to show them that I personally care about their success both in and out of the classroom.

Providing a lively classroom experience is the first step in exciting students about new topics, since students are more likely to stay attentive and absorb new concepts in classes they enjoy. To maintain a lively atmosphere, I strive to present material in an organized, clear, and captivating manner, while encouraging student-led discussions of any questions that arise. As in my research, I focus on teaching how to apply fundamental design principles and techniques in different contexts to build robust, efficient, and manageable systems, rather than focusing solely on low-level system-specific implementation details that many students are able to memorize. While technical prowess is certainly important, developing the ability to critique existing systems, as well as identify new problems and design novel solutions, prepares students for the world beyond college, where close-ended problems and their solutions are not written in a textbook.

I also believe that engaging students outside the classroom is as important as engaging them in it. Developing a personal rapport with students builds trust that often bolsters their confidence and encourages them to speak up in class and seek help after class. During a seminar I taught at Williams College in Winter 2009, I often chatted informally with students before and after class about a range of topics. In many cases, although not always, these topics were indirectly related to our discussions in the classroom. For example, after one class where we covered Google's AdWords and AdSense systems for pay-per-click advertising, a student approached me to discuss how to leverage Google's advertising in a small business she was starting. I also found that these informal discussions with the students led into productive discussions in the classroom. One student's question after class about how much energy each Google search actually consumes led to a classroom discussion of the environmental impact of using online services.

Another important way to excite students about topics is to relate them to technologies they use everyday. Luckily, systems-related courses offer ample opportunity to bring everyday technologies into the classroom. For instance, learning about a new distributed storage system to support low-latency access to many small-sized objects is not nearly as exciting as learning about how Facebook stores and accesses billions of photos. Additionally, developing new assignments that utilize the latest technologies not only motivates students, but also makes them competitive applicants for jobs and graduate schools after graduation. Since many of the popular software systems in wide use in industry and academia are open-source, systems courses provide a unique opportunity to experiment with real-world technologies. The primary goal of the "Inside Google" seminar I taught in Winter 2009 was to introduce students to the real-world technologies behind Google using Hadoop, a family of open-source projects that implement much of Google's underlying infrastructure.

Cyber-Physical Systems (CPS) offer a similar opportunity for student interaction, since CPS technologies are deployed in homes, buildings, vehicles, etc. For example, I often use my own home as a working testbed for both teaching and research. I have outfitted it with over 60 Insteon-enabled programmable wall switches and outlets to monitor and control each appliance's energy consumption, door trigger and motion sensors to monitor occupancy, remotely controllable Insteon-enabled thermostats for HVAC monitoring and control, as well as 24 sensors in the electrical panel to monitor energy consumption every second for the entire home its circuits. The deployment offers students an unique opportunity to work with a real in-home system in a working home that is impossible to recreate in a small-scale university lab setting. Students in the Green Computing undergraduate seminar I taught at Williams College in Winter 2011 helped to build, test, and deploy many of the original wireless energy sensors used in this deployment. The experience gave the students insight into both 1) typical energy consumption patterns for many household appliances and 2) potential issues with large-scale home wireless deployments (many outlets are in nooks, e.g., behind refrigerators, that disrupt wireless communication).

Of course, there is a limit to how much students are able to learn inside a classroom or lab setting. Teaching students about the inner-workings of existing systems does not teach them how to generate new ideas and advance the state-of-the-art. Independent student-led projects are useful in providing this experience in systems courses. These projects allow students the freedom to choose both the problem they work on, as well as its solution, and are often the beginning of full-fledged research projects. It is important to guide students first starting out on an independent project to help tailor the scope of the project to each student's strengths. While advanced students may be able to take charge immediately, other students may require more guidance in selecting a problem and appropriately limiting its scope. However, I believe the goal should always be to emphasize each student's own strengths and interests in selecting a problem, since students will only pursue topics they are are able to make forward progress on and are interested in.

The best teachers care about their students' success both in and out of the classroom. In the classroom, I believe that rapid and constructive feedback on assignments is important, since it allows students to study and learn from their mistakes. I also encourage feedback from students on my teaching. In the past, I have used an anonymous feedback form on the course web page to allow students to submit questions or comments they are hesitant to bring up in class. Teachers also have a big impact on a student's success outside the classroom, from providing advice on selecting courses to writing letters

of recommendation to passing on information about possible internship opportunities. While many of these activities are outside the scope of lecturing and grading, they often have the biggest impact on students' lives. An internship in college facilitated by a teacher may lead to a job after college that starts a student on a successful life-long career path. Ultimately, successful students—both graduate and undergraduate—are the hallmark of a successful professor.

In addition to teaching courses, I have also had the privilege of mentoring graduate and undergraduate students at UMass-Amherst. My approach to mentoring is similar to my approach to teaching. For graduate students to be successful, they must first be excited about the project they are working on and develop a sense of ownership over its outcome. Initially, developing a sense of ownership may be difficult, since junior graduate students are not always prepared to generate new ideas and effectively execute on them. In this case, it is still important to let students lead project discussions, and provide feedback when appropriate to guide them in the right direction. As students gain experience, they should also gain more autonomy to guide their own projects. That said, I take a hands-on approach to advising students, and consider them research collaborators from the outset. I also believe that there is a synergy between teaching and research. Since much of systems research focuses on adapting and extending existing techniques for new technologies and different settings, teaching provides professors the opportunity to familiarize themselves with past approaches that may not be currently in vogue. Additionally, young students often have a fresh take on ideas that more senior researchers may overlook.

Finally, as a faculty member, I am interested in developing and teaching courses on both basic undergraduate topics, such as introductory programming courses, and more advanced systems-related and specialty topics, including Cyber-Physical Systems, Green Computing, Wireless Sensor Networks, and Virtualization and Cloud Computing, as well as other timely topics in systems research. I recently taught a special topics undergraduate seminar on Green Computing at Williams College, a top-ranked national liberal arts college, during their Winter 2011 session.