Teaching Statement

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As a PhD student at Carnegie Mellon University, I have mentored individual students, guided group projects as a teaching assistant, created a new course as an instructor, and reached millions of individuals through online tutorials. In concert with my research interest of increasing the reachability of technology, I view instructing individuals on how to take advantage of that accessibility as an integral part of success in my work. In all of my teaching, I frequently integrate live demonstrations, interactive and physical artifacts, and videos to show how complex and abstract concepts can be easily understood when used to achieve meaningful and desirable applications. I thoroughly enjoy the experience of endowing my students with the knowledge and capability to achieve their goals. Witnessing the use of my contributions by individuals or institutions is, in my opinion, the ultimate form of validation.

Teaching in the Lab

One of the responsibilities that I have adopted in the Human-Computer Interaction Institute at Carnegie Mellon has been the creation and management our electronics and physical prototyping lab. This lab was originally created to support my own research, but ensuring that these resources were accessible to anyone has always been important to me. The lab and its resources remained open to anyone within our department, organized, stocked with tools and materials for small projects, and available for class use. I provided tutorials on tool usage and regularly advise students on parts and material selection and project designs. I worked with students to frame their project goals in a functional manner, scope them within their abilities, and discuss the pros and cons of different methods of achieving that functionality. I do not mandate design changes, but rather I give them the information necessary to make an informed decision about different implementation paths they could to pursue and make them aware of challenges they may face based on their decisions. My effort is to steer them toward paths of success, but I do not necessarily protect them from failure, since failure is often an invaluable educational experience in itself. This implicit position of running the hardware lab has resulted in my involvement with a very large number of research projects, undergraduate and graduate student thesis work, and class assignments. I view this as an important and valuable role in our department and it has given me a great deal of experience working with individuals of varying skill levels and ambitions.

Teaching in the Classroom

My teaching philosophy in the classroom is one of “learning by doing”. Particularly when it comes to hardware development and physical prototyping, there is no substitute for students actually building a working prototype with their hands or executing a real user study and experiencing first-hand the unexpected challenges that the real world provides. Theoretical study alone is insufficient for making robust and reliable designs that are really usable. My teaching aims to balance and explore the interaction between conceptual learning and physical execution.

As a teaching assistant, I have enjoyed two experiences of guiding groups of students in project classes. In "Mobile Computing & Applications", a semester long project course composed primarily of engineering students, my responsibility was to the create and mentor two HCI focused project topics - one on privacy sensitive location based services, and one on using HCI methods to evaluate an existing system. The HCI evaluation project was particularly successful producing a report that was immensely useful to the Intel Research client and an enlightening experience to the engineering students involved who have never been exposed to HCI techniques such as online surveys, contextual inquiries, and

cognitive walk-throughs. The engineering students, who had previously focused solely on software development, realized that just a small amount user interviews and user studies can provide critical feedback and quantitative data on valued features and software architecture even if the application does not have a traditional graphical user interface. My second experience was as a technical adviser for "Physical Computing and Wearables", a cross-listed rapid protoyping course composed of 20 students from human-computer interaction, entertainment technology, and art. The class included basic electronics prototyping and a wide range of project topics due to the wide range of student interests. My responsibilities involved the setup of classroom lab equipment, helping students debug their assignments, giving lectures on electronics, and helping students scope and design their end of semester projects. Because of the enthusiasm and imagination of the students, many of the proposed projects were over ambitious given the student's abilities. I always made an effort to scope their projects down in manner that preserved their enthusiasm and interest while guiding them toward a project they could successfully execute. This typically involved reducing the scale of the project or having them implement the first component of a much larger project which they could continue beyond the class, such as a thesis project.

This experience inspired me to coordinate with the department to create a new course specifically focused on "Electronics Prototyping for HCI" for which I was the instructor and designed the curriculum and lectures. Due to the high quality of the degree program, it is very rare for Carnegie Mellon graduate students to have sole responsibility in teaching and developing a new course. My class focused on enabling students to create fully functional interactive, input and output devices that were either stand-alone or interfaced with a computer. Advanced prototyping skills such as PIC processor development, printed circuit board (PCB) design, and surface mount work allowed students to create sufficiently sophisticated prototypes for use within their own research. My teaching score, as evaluated by the students, for this new course was 4.2 out of 5.0, which is well above the department average. I believe this was in part due to my dedication and willingness to given attention to individual projects in addition to compelling classroom lectures using vivid demonstrations of electricity in action when possible and the relevance of concepts to devices they use every day.

Teaching Online

Beyond the walls of the classroom and Carnegie Mellon, I have created online tutorials and technology demonstration videos that have received over 4 million unique views (as of 1/1/08) not including internet and print syndications. Excitement and attention to research ideas garnered by these tutorials and videos have generated over 200,000 software downloads, and over 6,000 shipped hardware units. I have also received hundreds of emails from high-school and undergraduate students whom I've inspired to go into computer science, human-computer interaction, and filmmaking.

The most recent of these tutorials explore the interactive capabilities of the Nintendo Wii remote. As of September 2007, Nintendo has sold over 13 million Wii consoles worldwide. This significantly exceeds the number of tablet PCs used today according to even the most generous estimates of tablet PC sales. This makes the Nintendo Wii remote one of the most common input devices in the world. It also happens to be one of the most sophisticated containing a 3-axis accelerometer and high-resolution high-speed infrared camera. I have viewed this as an incredible opportunity to demonstrate interaction techniques enabled by the Wii remote and to develop new applications that could be instantly accessible to millions of individuals. Although these tutorials are only a few weeks old, they have received over 3 million unique views and have been featured on several major news outlets. The *WiimoteWhiteboard* software I developed, that allows the Wii remote to create a low-cost interactive whiteboard system, has been downloaded over 200,000 times and is already in use by countless educators around the world, especially within developing countries, and several educational institutions

have expressed interest in adopting it for use in all their classrooms. My *Wiimote Head-Tracking* demonstration has inspired dozens of major entertainment companies to explore desktop virtual reality experiences in upcoming products. Back in the classroom, project courses at Carnegie Mellon University as well as many other universities are planning to explore using these techniques beginning this semester (Spring 2008). Students in computer science, human-computer interaction, design, entertainment, and art are already beginning to integrate these interactive ideas into their own work. These tutorials can be found at: http://www.cs.cmu.edu/~johnny/projects/wii/ (mirror: http://jobapp.johnnylee.net/mirror/projects/wii/)

As another example of my online teaching, in 2001, I created an online tutorial on how to build a low-cost camera stabilizer for only $14. This tutorial alone has been viewed well over 1 million times, featured in the premier issue of *Make Magazine*, and has been translated into over a dozen languages. It has become a staple of the low-budget/student filmmaking community and is currently used by a number of high school and college production classes. This tutorial can be found at: http://steadycam.org

As a teacher and a researcher, I firmly believe that the internet should be actively used as a tool for sharing educational content and increasing the public awareness of research. Not only is there an immense social impact of reaching millions of individuals with an idea that they can immediately apply to improve their lives and educational pursuits, this level of awareness also creates industrial and academic connections that span institutional and national boundaries significantly advancing the state of research.