Harrison Williams – Teaching Statement

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The most memorable teachers throughout my academic career were those who supported and developed my passion for understanding and building complex computer systems through instruction of fundamental concepts, feedback on my work, and a shared enthusiasm for the topic. As an educator, I hope to inspire and lead students in the same way. In both classroom teaching and research mentoring, my goal is to develop **independent and intellectually confident** researchers and engineers with the foundational knowledge and broad skillsets needed to solve real-world problems.

Teaching Experience, Philosophy, and Interests

My approach to teaching is informed by my experience working with students at both the undergraduate and graduate levels through TAing, lecturing, and guiding students in small groups.

Undergraduate Instruction As a graduate student, I was a TA for Virginia Tech's upper-level security class CS 4264: Principles of Computer Security. My time working with students during office hours and guiding discussions online showed me the value of meeting students at their current level of experience and building to high-level concepts from there, often by working through examples and illustrating the thought process behind concepts and design choices. I found working through representative examples encourages students to engage with ideas at the pace that works best for them: an example can start simple and understandable and gradually gain complexity as students develop an understanding of the concepts it represents, keeping them from feeling "lost" grappling with high-level and often abstract design ideas. I also revamped the grading infrastructure and starter code distributed to students for homework and projects. I learned here how an initial investment in a robust and extensive framework for course administration—not just autograders, but TA guidelines for each project, well-documented solutions with common sticking points for students, and repositories with external resources on each concept in the class—pays off by freeing up time for both the instructor and TAs to focus on developing students' understanding of the topics at hand.

Graduate Instruction As a senior student, I also had the opportunity to give a guest lecture on my research for a graduate-level architecture class at the University of Michigan. Lecturing at the graduate level requires a different approach from undergraduate instruction; rather than building students' technical toolkits to accomplish a defined goal set out in the syllabus, my goal is to get students excited about and interested in applying their already-developed technical expertise to a research area. To that end, I chose to focus less on pure technical content and instead explored exciting application areas and fascinating higher-level research questions—the same areas and questions that drive my own passion for my field. I found that this approach to lecturing motivated students to ask more questions and more actively engage with the material than describing meticulous paper-level technical details.

As a postdoc, I participated as a mentor in Virginia Tech's writing workshop for students applying for the NSF Graduate Research Fellowship Program. Mentors reviewed each student's application package and worked with students in small groups (4-5 at a time) to both give direct feedback on writing and facilitate a peer discussion of the student's work. This experience opened my eyes to the challenges of teaching young researchers effective communication: students vary wildly in their writing ability when entering graduate school, both because many students are non-native speakers and because even native speakers may not have taken an English class in years. While the gaps in each student's knowledge were unique, one common theme I noticed was that early-career students tend to focus on lower-level details at the expense of the high-level themes and contributions of their work. I encouraged students to take on the perspective of an unfamiliar reader (e.g., a funding proposal reviewer) and to consider primarily what the target audience *needs to know*, such as intellectual merit and broader society-level impact. As communication is an essential yet under-emphasized component of a successful research career, I specifically intend to seek out pedagogical resources to continue developing my own skills as a mentor for technical writing and communication.

Teaching Philosophy I approach teaching as a collaborative effort between the teacher and student; the job of the teacher is to gradually introduce concepts, observe the student's thought process to find gaps and misunderstandings, and serve as a *resource* while students work through a problem or concept. I have found the most success teaching with a mostly-hands-off and question-based approach, encouraging students to vocalize their thought process and only actively intervening if they stray far off course. Allowing students to "lead" as we work through material gives them ownership of their ideas and encourages them to develop ideas further, giving them the tools and confidence to learn concepts independently. I plan to translate this approach to the classroom through project-based learning developing tangible systems integrating the concepts in the curriculum (e.g., learning signal processing concepts by building an audio recorder/player). My experiences both as a teacher and student have shown me that this approach both increases student engagement and fosters a system-level understanding often missing from classes focused on rote learning and problem sets evaluating concepts in isolation.

Teaching Interests My research area and interests span computer architecture, embedded systems, and circuit design. At the undergraduate level, I am looking forward to teaching courses in any of these general subjects. At the graduate level, I am particularly interested in developing and teaching courses that take a "deeper dive" into one of those areas (e.g., ultra-low-power embedded system design or architectures for secure computing) to work with students applying cutting edge techniques to real world problems.

Mentoring Experience and Philosophy

Advising Style As a senior student and now as a postdoc, I have had the opportunity to mentor students both in and outside my research group at Virginia Tech with various levels of formality—ranging from scheduled weekly meetings to impromptu research discussions in the lab. These experiences, combined with my own personal experiences as a student, have shown me that the role of the advisor changes dramatically as a student develops into an independent researcher. A key component of this shifting relationship is to gradually transfer control over a student's research directions to them as they develop from a research *assistant* to a research *leader*. I have observed that students do well when they can first focus primarily on developing the "mechanical" skills associated with research: system development, experiment design and execution, and paper writing. As an advisor, I plan to encourage this by starting students out with well-defined research problems and an outline of how to approach them. As students mature into exploring their own lines of research, I will step back and allow them to lead question formulation, technical planning, and execution—taking on the role of a research *peer* offering high-level feedback and suggestions instead of close technical direction.

Lab Management Success in research depends on more than pure technical ability; I want to foster a positive lab environment that encourages students to develop the communication, collaboration, and time management skills necessary to succeed in the research world. As such, I will give students opportunities to develop these skills by giving regular practice talks in the lab, seminars or reading groups, encouraging collaboration within and beyond the group, and working on funding proposals, paper reviewing, and disseminating their research in ways beyond conference and journal articles. I have also seen how essential positive feedback and experiences are for keeping students motivated in the face of graduate school's many trials and inevitable rejections; I plan to coordinate regular group outings, meals, and celebrations of major milestones in order to reduce the stresses associated with school and research. Finally, I strongly believe that research is a highly *creative* task—one that requires a supportive and encouraging environment and a healthy work-life balance. I will encourage students to prioritize their physical and mental wellbeing, approaching their work in a sustainable way that avoids burnout and supports a successful and fulfilling long-term research career.