Teaching Statement: Phillip Rogaway

Becoming a university professor (personal homepage) was a calling, not a job. I did well at both research and teaching (CV, Google scholar, teaching evals). Yet as early as a decade ago I started to feel that it was time to move on.

I always loved teaching, but I once valued research even more. Gradually, I changed my mind on that. I had seen how profoundly my teaching could change student lives. Students would tell me so. I started to feel that my valuation of research over teaching might have been a bit arrogant ("anyone can teach, only a few people can be top researchers") and, also, a bit conformist ("my institution values research above all else, I guess I should, too").

More factors were driving me retire from the university, or quit. Age, of course; mathematics is often seen as a game best played by young minds. But, more than that, I had come to dislike the trajectory of my area (cryptography), my field (computer science), and my department (increasingly shaped by corporations, careerism, and AI). I had fought against these trends for years—and lost. By 2020, of the various things that a professor should do, I was enjoying only teaching. Not ideal.

Computer science was always an odd place for me to land. I loved the game-like aspect of theory, but I viewed computers themselves with mild disdain. When social media and then smart phones emerged, the disdain grew less mild. Human-phone hybrids seemed to replace our university students. I would walk around campus and try, unsuccessfully, to make eye-contact with them. And I would think: *my discipline has brought us this*? I'd feel ashamed.

Around that time I enlarged my teaching beyond math and theoretical computer science to include a class I designed on ethics and technology (editions.2004-to-2023). This soon became about half of my teaching. Often I wondered if it was my social responsibility to teach nothing else. But I loved teaching classes in two different veins, STEM and the humanities. I also liked to find ways to integrate the two. My favorite scientific papers exemplified beautiful writing, while my favorite technical classes were stories beautifully told. Were there really so large a gap?

My technical classes aim to get students to think creatively, abstractly, and playfully. The material is the substrate, not the goal. These classes also aim to help students learn to communicate more clearly. My ethics classes, as well as my recent class on *Black Mirror*, aim to push STEM students to genuinely care about the state of the world, the social impact of their own work, and the social and environmental consequences of our collective work. I want these considerations to shape students' personal and professional choices.

All of my teaching aims to foster an environment of inquiry, inclusivity, and respect. I want students to feel profoundly *seen*. And I want our shared experience to be something that a student will remember, fondly, all of their lives.

I try to teach from a place of total honestly. We are here to engage in a discussion about our topic. I don't know everything about it; I am learning, too. We'll see where our exploration leads.

My teaching often includes idiosyncratic elements folded in to enrich community, kindness, fun, or broadmindedness. The technical classes are intellectually intense, increasing the need to humanize them. So I've taken my students to hike in the Sierras, and to climb at a local gym. We've gone outside to watch the grazing goats, or to pet the campus cows. I screen films—sometimes arranged, pre-theatrical release, with the filmmaker. I bake vegan treats. I'll hold a "dog day" when students are encouraged to bring their dog to class. I hold "postmortems" where we go over students' final

exam the term *after* a class has ended. I read aloud from a 19th century children's book that apparently shaped Alan Turing's thoughts. And so on. I want my classes to be as interesting and deliberate as my research.

Of course I'm not suggesting that these things that make sense in a K-12 setting. I will find new things.

I've done enough volunteer K-12 teaching to know that I like it just as much. It doesn't feel all *that* different. No matter a student's age or abilities, you meet them where they are. You treat them with respect. You try to craft an experience where they'll thrive. Let me list a few of my K-12 experiences.

For many years I have tutored, one-on-one, the bright children of some university colleagues. We work on math competition problems or walk random mathematical paths the student wouldn't otherwise get to take. For example, we'll explore life in $\mathbb{Z}_n$, or undecidability, or the size of different infinities. We'll count something tricky to count. Students get excited at the creativity and accessibility of mathematics beyond that which gets memorialized in school curricula.

As my own son progressed through the grades, I would make guest visits to some of his math classes. This began with a series of graph-theory lessons for 1st graders. (Graphs, in this usage, are a combinatorial object.) Not only can a 1st grader "get" graphs, but they're more fun than the natural numbers.

Recently I covered a 9th grade math class for the kids where my son is studying this term, at UWCT. It was an introduction to thinking recursively. Even rather "advanced" material *can* be taught to students of this age if one develops it well.

I've taught cryptography to 8th to 12th graders under a California program called COSMOS. The students seemed, if anything, *more* creative than their college-aged counterparts. For example, we looked at the *dating problem*, where Alice and Bob want to determine if they both want to go on a date with the other. If a party doesn't want to go on a date with the other, they should learn nothing about the other's interest. No trusted intermediary or fancy tech may be used. This is a classical problem in cryptography. But the nicest solution I had seen, for years, came from a 15-year-old girl in a COSMOS class.

My experiences teaching math to both kids and university students has made clear to me that the way math is usually covered in K-12 settings is kind of awful. It tends to be boring and procedural. The treatment even runs contrary to the spirit of math as an abstract, artistic, and creative endeavor. Paul Lockhart's wry essay A Mathematician's Lament provides a caustic but insightful appraisal.

Disinclined to return to a university but missing teaching terribly, at this point in my life what I'd like most is to teach in an innovative K-12 setting. Colleagues tell me that it's a crazy idea. I think that they're wrong. For me, it's the best way to give back.

All of my course homepages are on the web. Summary statistics, as well as comments culled from my last couple of classes, can be found here. I would encourage anyone reviewing my teaching to *read student evaluations*. Nobody knows what goes on in a classroom better than the students taking a class—yet they are so often unheard.

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