Robert Craig Group

Teaching at UVA

I enjoy teaching. In fact, the challenges and joys involved in efficiently exposing students to powerful knowledge are exactly what brought me here to the University of Virginia.

My father was an English professor at a small college campus in South Carolina. As a result, I have always valued teaching as one of the most noble professions. Through my teaching responsibilities over the last 20 years at four different college campuses I have had the chance to lecture on multiple topics of physics. In addition, as a student I developed my teaching skills through many years of private tutoring. More recently, several focused teaching workshop have allowed me to continue to evolve my teaching techniques towards pedagogy proven effective by recent data-based studies.

During my first semester here I taught PHYS 2020, an introductory class of 200 pre-medical students. I survived that first semester, but it was challenging in ways that I didn't expect. That summer I attended the New Physics and Astronomy Faculty Teaching Workshop which is held annually by the American Association of Physics Teachers. The workshop is an intense three-day introduction to pedagogy that has been proven to be effective in teaching physics. The experience opened my eyes to new techniques and to a large body of research supporting the value of incorporating strategies that deviate from the classical lecture. When I taught PHYS 2020 again the next year I improved the class by incorporating several techniques that I learned from the workshop. For example, I made the in-class response system a larger component of the lecture. When it was clear from the response system that a concept was not understood by the class, I encouraged discussion and allowed a few minutes for students to "convince their neighbor" before polling the class again. The response system combined with the follow-up peer instruction seemed to improve the effectiveness of our lecture time. Another related technique was to include a pre-class quiz before every lecture to encourage students to read the text. I promised them that I would not cover everything in the book, that as college students reading was their responsibility, and that I would use the extra class time for more interactive purposes. I assured them that these techniques were proven to improve their learning. I think that overall the class accepted this strategy, read more in advance of class, and learned more during our lecture periods.

I use many physics demonstrations in class. While teaching PHYS 2020 I realized that I was truly enjoying the process of setting up and learning how to use each of the demonstrations and presenting them to the class. I thought students might enjoy this as well, so I presented it as a "Dream Idea" to the Mead Endowment at UVA. With the award, I hosted a series of meetings with Physics majors in which we investigated demonstrations that were available, and even purchased some new ones for the Physics Department. Two undergraduate students presented some of our demos at the annual "Physics Day" event in front of about 200 middle school students. I'm happy to say, it has has turned into a tradition to involve undergraduate students from SPS in the Physics Day presentation each year.

In 2015, I participated in the Course Design Institute at the University of Virginia. The goal was to redesign 1610 (the first course in our introductory physics major sequence) into a new 5-hour course (1710) that would help us combine our 3-semester introductory sequence into a 2-semester sequence. While designing the course, I realized that some of the things I wanted to accomplish in the course was to teach students what it takes to be a successful college student, a successful physics major, and to wellcome them to our department. I included several activities to insure that the students reflect on their learning. I also introduced them to Society of Physics Students early with the hope that they would find community in our department.

Most recently, I have focused my efforts on computational physics and data science. I taught our "Introduction to Scientific Computing" class for 3 years. It was based on C, and focused on solving some simple physics problems computationally. I recently started a new course in the physics department called "Introduction to Python for Scientists and Engineers". Along with an introduction to the PYTHON programming language, the course introduced three core skills: analyzing data, simulating data, and visualizing data. In the last two weeks of the course we discussed machine learning and even introduced Scikit-learn to train and evaluate a neural network (an example of machine learning). The course assumes no prior programming experience or knowledge about the inner workings of computers. It concentrates on applications to common problems in science and engineering and with an emphasis on general data science tools.

In my opinion, one of the most important thing that scientists can do is serve as a role model and to donate some of their time to another interested mind. Often, this effort results in a greater understanding for both parties! For Introductory physics courses, I always take the last lecture to show them how the physics they learned in class could help them understand my research. I always invite the potential Physics majors in PHYS 1610 to the meetings of the Society of Physics Students and encourage them to "Think like a scientist!". For the last 10 years I've instigated the policy of taking three or four top performers to lunch after every exam. My classes have been rather large, and this gives me a chance to get to know some of the top students in the class in addition to the ones that are struggling and that I meet through repeated visits at my office hours. In office hours, or outside of class, I'm always thrilled when a student asks about my research.

In summary, I'm here at UVA because I want to teach and mentor students and I have put every effort that I can afford into doing it well. I work hard to have a positive impact in the classroom and to serve as a mentor to students both in and outside of class. I rank my success as a mentor and a teacher among my highest accomplishments and I look forward to the opportunity to teach students of physics at every level and to improve my technique for years to come.

For completeness, I include a list of my past teaching and outreach experience in my CV.