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Teaching Statement

The most important thing I can say about my teaching is simple: I love teaching. I like waving my arms and raising my volume as the intellectual tension builds and the Second Law of Thermodynamics is finally revealed. I enjoy reading The Physics Teacher and American Journal of Physics and learning about new teaching techniques. I cannot explain the excitement of office hours, when sometimes the student makes those critical connections for the first time. I labor over the order of topics in my course syllabi for the next semester. I playfully explore the newest physics demonstration or Java Applet while scheming how to integrate it into the next class. I feel such satisfaction when a student provides the class with a well-reasoned justification for their opinion on why the pith ball could be neutral. Truly, I do not love grading, but every silver lining has its cloud.

Teaching Experience

The courses I have taught are listed on my C.V. How I teach a course depends on the audience, the size, and the topic. I have taught classes with only 3 students and classes with 189 students. I have taught courses for non-science majors, introductory courses for science and engineering majors, and a variety of upper-level undergraduate courses. The only commonality between the way I have taught and would teach these various kinds of classes is that I always think techniques of active learning are appropriate. Physics education research has provided compelling evidence that active learning techniques lead to increased gains in conceptual knowledge and problem-solving skills.

Introductory physics: Introductory physics is the bread-and-butter of my job. Typically, such courses have the greatest volume of students, and they almost always require the most patience and work. Many students need to be convinced that physics is not torture, and I will do anything to engage them.

- Following methods developed in Harvard physicist Eric Mazur's book *Peer Instruction*, the students all have remote controls, "zappers," with which I poll the class for real-time understanding of tough conceptual questions. I also allow time for peer discussion about a question, or use the devices to have students make hypotheses before doing a demonstration.
- With a grant, I developed video-based learning activities distributed over the internet. Students and I have made short movies to emphasize strategies and concepts for problem-solving, a big component of intro physics.
- During the last four semesters, I have tried a new approach to introductory physics using the techniques of Just-in-Time Teaching. Just-in-Time Teaching requires the students to complete a web-based activity on the material before they come to class. I use their responses to guide the classroom discussion. The advantages of this process are that the students come to class already thinking about the material, and I have already uncovered some of their most pressing concerns and misconceptions.

- Starting at Rice and continuing at American University, I developed substantial course websites and took advantage of web classroom management systems (like WebCT and Blackboard) to automate on-line quizzing, surveys, and solution posting.
- I have experience revising undergraduate laboratories for introductory courses at both University of Texas at Austin and at American University.

Upper-level undergraduate seminars: I have taught quantum computing, classical mechanics (twice), electromagnetism, waves and optics, and quantum mechanics to small sections (between 9 and 17 students) of upper-level students. While such courses typically follow the pattern of lecture in class and problem-solving outside of class, I have found that there are many other ways to engage the students and make class time more productive.

- I have used Just-in-Time-Teaching in classical mechanics. I think it works even better with upper-level students than with introductory students.
- Even in a very theoretical class, hands-on experimentation with simple models or computer simulations brings the content alive for the students. For instance, in electromagnetism I gave the students open-ended problems involving classic physics demonstration equipment such as the Van de Graff generator and Tesla coil. In classical mechanics, I had students perform MatLab simulations of class topics like trajectories with air resistance.
- We have occasional "mini-conferences" on particular suites of homework problems. Students present the results of homework problems individually or in small groups and take questions from the class. This encourages students to develop a professional style of communicating physics.
- Encouraging peer discussion and group problem solving in class leads students to form productive collaborations outside of class. I have used such techniques to make the class feel like a cohort and to stimulate discussions.
- I taught a course in quantum mechanics in seminar style, with students doing presentations for over 70% of class time.

	PHYS-350 Electricity and Magnetism Spring 2004	PHYS-110/110G University Phys. I Fall 2004	PHYS-105/105G College Phys. I Fall 2004	PHYS-210/210G University Phys. II Spring 2005	PHYS-330 Waves and Optics Spring 2005
Number of students responding/enrolled	8/8	28/33	20/25	34/37	12/14
Overall Course Rating	5.63/6	5.64/6	5.2/6	5.44/6	5.33/6
Demanding Course	5/5	4.93 /5	4.75/5	4.75/5	4.75/5
Overall Instructor Rating	5.63/6	5.89/6	5.55/6	5.68/6	5.83/6
Consulted Instructor more than 7 times during semester	75.0%	50.0%	45.0%	38.2%	50.0%

Table 1: Summary of some SET data from courses I have taught at American University.

Teaching Physics outside the Classroom

Fostering student research is one important way to enrich students, prepare them for technical or academic careers, and provide them with outlets for greater responsibility, creativity, and self-direction. I have supervised several research projects and believe such activities are crucial to completing a student's education.

Encouraging physics majors in their academic careers and supporting expanded opportunities for student development are part of my job as the physics program undergraduate advisor. I have helped students apply to graduate school and directed students towards summer research internships. I am currently the faculty advisor for the Society of Physics Students at American University. My office hours are well-attended and I hope my students think of me as an available and interactive professor.

A successful physics department requires its faculty to play multiple roles that evolve over time. I am committed to maintaining a supportive atmosphere for my faculty and colleagues and enjoy being part of a team and taking on leadership roles when necessary. At American University, I have been a part of multiple department committees, working on topics from upgrading the introductory laboratories, redesigning the undergraduate curriculum, and student recruitment.

Conclusion

I have learned a lot about teaching from my colleagues and from my students over the years. I plan to keep evolving as an educator, and I plan to die in front of a blackboard of a heart attack when some student says something strikingly Aristotelian. HAHAHAHAHA.