Teaching Philosophy

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I believe that education should focus not only on technical scientific content, but also on developing the diverse set of skills necessary for a successful career. As someone who has had training in several disparate fields, I am a strong believer in an interdisciplinary approach to teaching. My career has thus far spanned astronomy, plasma physics, nuclear engineering and policy, and I have drawn on a diverse set of skills across these fields.

In addition to problem solving, skills critical for success in science and engineering include working as a team, public speaking, and effective communication. I believe a good curriculum should integrate all of these approaches to acquiring technical content such as physics. As a teaching assistant for introductory physics courses, I structured my discussion sections using an interactive framework that allowed students to develop these skills. My discussion sections were focused on peer-lead problem solving. I began with a brief technical review of the material, and then distributed two or three challenging problems that highlighted the most important points. The students worked in small groups to solve the problems, and then different groups were asked to present their solution in front of the class. If the group was unable to solve the problem, they solicited assistance from the rest of the class and everyone worked together to come to an answer. This approach allowed students to learn the material by teaching and explaining it to one another. By rotating the presenters, the students also gained experience in public speaking and communication.

The other feature of my discussion sections were frequent, low-stakes quizzing. Short ten minute quizzes were given every other week. These quizzes served to both reinforce the important concepts in the course and also provided me with feedback on areas that were especially difficult or were leading to confusion. On occasions when a large fraction of my class did not correctly answer a problem, I was able to identify fundamental gaps in their learning and add a targeted lesson for clarification. Furthermore, the frequency of the quizzes reduced the impact of an single one on the students overall grade, so they were able to make the mistakes that are sometimes needed to really learn the material, without being penalized by a single, high-stakes exam.

Of course, teaching a large lecture course is somewhat different from a small discussion, and it may not be feasible to give all students the opportunity to present their solutions in front of the larger class. Nonetheless, there are many opportunities for

an interactive teaching approach in a larger course as well. Peer-led problem solving can still be encouraged through small group work, demonstrations can be combined with predictive polling to keep the students engaged, and short quizzes can be used during lecture to assess student progress. Engaging the students in discussion of the material is critical to the learning process.

An additional benefit to a diverse teaching approach is that it gives all types of learners the opportunity to draw on their individual strengths. Some students are already comfortable with public speaking, while others are better in smaller groups. Having a large number of quizzes through the semester distributed the students grade among many smaller contributions, which helps to reduce test anxiety. Interspersing demonstrations and small group discussion with conventional lecturing helps to reach those students who are not engaged by traditional lecturing or individual problem solving. It also makes the course more engaging and builds a community out of what can otherwise be a large and relatively anonymous experience. An interactive approach, which has been shown to increase understanding of course content, ultimately gives the students both the technical knowledge and a solid foundation in the fundamental skills needed to be successful in our modern, rapidly evolving economy.