TEACHING PHILOSOPHY

During my undergraduate studies, I had several professors who encouraged me to pursue my interests in biology and mathematics. I was fortunate to have professors who engaged my interests by having me work on real-life, important problems in their classes. Therefore, I strive to create a student-centered environment in my classes. As Ambrose et al. (2010) argue, students are motivated to learn only when students value the material, believe they can succeed, and are in a supportive environment. I see these three properties as levers I can control as an instructor. To fine-tune these levers in the classroom, my teaching philosophy focuses on three key principles: 1) active learning engages students, 2) meaningful projects should guide learning, 3) courses should be taught with an interdisciplinary mindset.

Students should be engaged in their own learning through active learning. Several studies have documented the ability of active learning activities to promote student learning and student retention in STEM disciplines (Freeman et al. 2014). Active learning activities places students in charge of their own learning. For example, I was the sole instructor for a biology bridge program (or bootcamp). I designed the curriculum to focus not only on biology, but also to introduce students to the scientific method. Instead of presenting slides on how the scientific method works, I divided the classroom into small groups and then handed each group a box with an unknown object inside. Students were not allowed to look in the box, but instead had to collect evidence about their object and form hypotheses. They then evaluated each other's claims—their first taste of peer review.

Students should work on real-life, meaningful projects and problems. One common complaint from students is having to complete busy work, perceived as not relevant to their interests or career plans. Further, even when problems are written to be "applied" they often turn out contrived and uninteresting. I thus strive to create real-life, meaningful problems in both formative and summative assessments. A lot of my teaching has been in biology classes where mathematical skills are emphasized. For example, in my graduate-level mathematical biology course, I have a specific lesson centered on the qualitative behavior of differential equations. Instead of simply going through the math, I set up the problem of native and invasive plant species in Hawaii. Students were much more engaged with this biological motivation.

Students should be able to see connections between different fields. Even within a student's degree program, courses are often viewed independently, in math you study math, in biology you study biology, and so forth. In my courses, I try to integrate material from other courses. For instance, in the biology bridge program, I had a strong focus on quantitative skills throughout the course. For example, during a lesson on exponential versus logistic growth, I delivered a brief lecture and then let students loose on a problem. They had to develop a mathematical model to understand the dynamics of the squirrel population on campus. Students were evaluated on their biological understanding, the application of a mathematical model, and their interpretation of the results of the mathematical model.

As a scientist, I look for evidence for and against possible hypotheses. My teaching is no different. I view teaching as a scholarly activity. I improve my teaching through two different mechanisms. First, I read scientific literature on pedagogy and I also participate in workshops and courses on teaching. Second, I also use pre- and post-assessments in all my courses. This helps me understand what aspects of the course need to be improved. My undergraduate advisor, argued that, "all students are capable, just uninformed". With this mindset, a student-centered approach, where students take charge of their own learning, is appropriate. I implement a student-centered approach by having students participate in active learning activities (from think-pair-share to flipped classes), including those focused on meaningful, real-life problems. I also stress the connections between the material in one course and that of others.

S. A. Ambrose et al., *How Learning Works* (John Wiley and Sons, San Francisco, CA, 2010).
S. Freeman *et al.*, *Proc. Natl. Acad. Sci.* **111**, 8410–8415 (2014).