Teaching philosophy - GeologicalSciences

Global warming and climate change, ever-dwindling natural resources, energy, health affects linked to air and water pollution – these issues, now more than ever, have taken center stage in the public sphere, and geology departments find themselves uniquely positioned to equip our future scientists with the tools they will need to meet these challenges. A quick survey of department names finds "geology" being replaced or supplemented by words such as "planetary, atmospheric, environmental, mineral, and Earth sciences". These changes reflect the increasingly interdisciplinary nature of the field, and our faculty are responding to this opportunity. I can make an impression on a student when I can explain how the chemical reactions that erode mountain ranges can be utilized by the material scientist who is trying to harness similar reactions in fuel cells to generate energy; or show how the understanding of mineral-organic interface that is so vital to the formation of the Great Barrier Reef is also vital to the life scientist who is researching the re-growth of injured bones; or explain to the nuclear engineer who is looking for new materials to safely immobilize nuclear waste to start by looking at grains of sand - with compositions of minerals that have proven to be resistant to weathering over the last billion years. The more that you can show the broad applicability of a concept across different disciplines the more easily that concept can become rooted in the mind of our students, and the more seamless it will be for these scientists to move from discipline to discipline to deal with our challenges.

Our students are the future paleontologists, oceanographers, economic geologists, climate scientists, geophysicists, environmental engineers, to name a few. Thus, we face the challenge of teaching the fundamentals in a way that they can be applied across extremely diverse disciplines. A goal in this regard is to nurture a student's innate curiosity about the natural world. No matter the course name, I start my classes with students making observations in their own backyard, or taking note of the geology they pass on their way to class in the morning. What kind of rocks and soils do you see? What landscapes surround you? What features do you see on the horizon? Then we begin to ask the curious questions: What factors have shaped the landscape? How has the geology influenced the people, the economy, and the history or an area? How does the landscape fit into the geology of the larger region? Introductory surveys and questionnaires (along with student assessment surveys throughout the course) are integral to my being able to tailor a course to the diverse interests and needs of my students and allow me to make connections between the abstract theories that I scrawl on the chalkboard and the realities of their lives outside of the classroom. Whenever possible, we take field trips to a site for discussion, and when this is not feasible, we use tools such as Google Earth to stimulate conversation.

As geoscientists we attempt to explain processes that occur over a range of pressure, time and space scales that many students struggle to wrap their brains around. To this end, I believe strongly in the use of models and examples to help students in class to visualize everything from crystal structures to complex fold and fault structures. Whenever resources allow, the use of computer modeling programs such as CrystalMaker to build and manipulate crystal structures or PHREEQC for aqueous geochemical calculations can be invaluable tools in the geoscience classroom.

I believe strongly in the method of learning by teaching, and I regularly incorporate opportunities for students to teach their fellow students in discussion or lab sections. A student has truly learned a subject when they can teach it to their peer. This is why research projects that culminate in oral presentations or class poster presentations are an integral part of any syllabus I develop for a class. In order for a project to be meaningful it has to be developed throughout the entirety of a class and not just in the last few weeks so that the students ideas about their topic can evolve as their knowledge about the subject evolves. The ultimate goal is to allow students to explore their own interests in the context of the class as well as giving them yet another opportunity to engage their peers.

The teachers that have most affected the trajectory of my life are those that can make the strongest connections between the abstract theories scrawled out on the chalkboard and the realities of life and nature outside the classroom walls. This is especially true in the geosciences where we attempt to explain processes that occur over a range of pressure, time and space scales that many students struggle to wrap their brains around. This difficult task can be made easier by showing how an understanding of the natural processes that shape the surface of the earth are important to everyone, not just the dusty geologist in the field measuring dip and strike.