Teaching Statement

Dr. Jacob Adler

I am passionate about teaching and have been sharing my enthusiasm for Earth and planetary science with others since high school. I have taught both large undergraduate-level and smaller graduate-level courses at Arizona State University, presented guest lectures in geology and remote sensing classes, and have advised a diverse set of students ranging from high school interns to Ph.D. students. From these experiences I have learned that there is much more to teaching than what occurs in the classroom. I formed my philosophy both from my teaching experience and from the positive experiences I had as a student. My goals are to 1) help students learn to "think like a scientist" by becoming involved in research, developing testable hypotheses, and becoming independent, 2) help students apply the math and theory they learn in the classroom to real life examples, and 3) adapt my philosophy over time.

1 Thinking like a scientist

Inside the classroom, I aim to expose undergraduates to research opportunities through discussion and projects. Students should not only learn the class material, but hear about related research being conducted in their department, current events, and career paths. As a student, I enjoyed when a class had a semester-long research project. Course projects enable students to learn skills for long-term time management and practice each step of the scientific method with personalized feedback. These research projects could also lead to students presenting their research at a conference like AGU or LPSC, continuing the research after the semester ends, or even publishing a paper. Students could begin brainstorming research ideas during the first few weeks of class and propose potential project topics for feedback. After approval of a project, students could turn in a proposal containing the objective, background, methods, timeline, and references. Throughout the semester students would receive constructive feedback and suggestions from their peers and professor on their projects and presentations. This style of teaching prepares students for research through deliberate practice of proposal writing, hypothesis development, data gathering, and public speaking. It also prepares them for industry or non-academic careers, where project management and group presentation skills are equally necessary.

2 Relating to real examples

Experience in the field is also a critical part of the learning process, especially in geology or remote sensing. Understanding the orientation of geologic contacts, measuring outcrop mineralogy, and analyzing textural features can be difficult in the field. These field experiences also often lead to different interpretations from the initial classroom assessment of orbital images. I have found that students learn a great deal from field trips, especially hands-on and visual learners. Students have expressed increased enthusiasm for studying geology when they learn that they have the tools to investigate their surroundings in new ways. After I led ASU Ph.D. students on a planetary analog field trip to Death Valley, the students returned to these field sites and published papers and dissertation chapters about the analog environments we visited, comparing processes on Earth to those on Mars.

One technique I teach students is to examine geology at multiple scales. Each scale provides different insights and can change your assessment of working hypotheses. While at ASU, I shared a set of orbital images and airborne thermal infrared images before our graduate-level class headed to Death Valley. We discussed what we expected to find based on the infrared spectra of various geologic units, and what sites we could visit on our traverse to test our hypotheses. At our field stop locations, we assessed the composition, stratigraphic relations, degree of weathering, distribution of clasts, spectral mixing, and desert varnish thickness and how these factors changed some of our initial interpretations.

For each of the six undergraduate geology classes that I taught at ASU, I had students stop at a distance before approaching Hayden Butte to make observations of the two rock units, try to locate the contact between the two, and infer their histories. We then walked up to outcrops at several field stops, examined phenocrysts with hand lenses, measured strike and dip angles of beds, and created a geologic map and cross section of the butte. At each scale we can learn about the geologic history and students learn how valuable it is, for example, to have a robotic rover geologist on Mars to test our hypotheses

made from orbital data. Often I see planetary science papers today jump to an interpretation, and then support it with details (a classic case of confirmation bias). This leaves no room for alternative working hypotheses and has led to misinterpretations. I believe it is important to teach students how to start a geologic investigation with detailed observations and then form an interpretation afterwards, leaving room for multiple working hypotheses.

3 Philosophies should adapt

Like students, I believe as professors we are constantly learning and should be flexible in our methods to achieve a greater impact on student learning. I read books about effective teaching methods, invite peers to review and critique my style, thoughtfully consider student feedback, and adjust to different situations (like online learning during the pandemic). One technique I would try in the classroom is taking breaks for partner discussion. In my graduate courses, I found I learned the most from instructors who paused every 20-30 minutes to have students pair up with their neighbors and explain the material. This could be followed by an example problem for the class to think about and discuss as a group. Hearing a student's thought process out loud is a great way to gauge class understanding.

Finally, evaluating the effectiveness of my own teaching methods is a critical part of the teaching cycle. In our paper "Landing on Mars: a cross-institutional research-based seminar series," accepted to the International Journal of Teaching and Learning in Higher Education, we describe how we designed exit surveys for the students (who all attended our hybrid in-person and online course) and identified aspects that led to low and high student engagement with the material.

4 Specific experience and plans

My traditional teaching experience includes teaching a total of 180 undergraduates over 6 sections of an Introduction to Geology Lab course, teaching a smaller seminar class (Mars Landing Site Seminar) with 6 Ph.D. students, and leading a field trip class (Planetary Seminar) of 10 Ph.D. students. Details of my guest lectures to Remote Sensing and Geology of Mars classes at Georgia Tech and ASU can be found on my CV. Non-traditional examples of my teaching experience listed on my CV include developing a syllabus for and teaching a new Earth and Space Exploration class at an adult prison in Arizona, presenting public lectures for kids and adults, and tutoring with the Prison to Professionals program.

As a planetary scientist, I have the background to teach both terrestrial geology and Earth science courses as well as several planetary topics. Some courses I am most interested in offering or contributing to include: Planetary Geomorphology, Planetary Sedimentology, Remote Sensing, Geology, Planetary Field Camp, Geology of Mars, Astrobiology, and an Astrophysics Lab. I am willing and able to teach other courses as needed.