



Teaching Real Science: A Novel Approach to Engaging Students in the Scientific Process

Lev Horodyskyj (1), Chris Mead (2), Carol Oliver (3), and Ariel Anbar (2)

(1) Arizona State University, Tempe, United States (LevH@asu.edu), (2) Center for Education Through eXploration, Arizona State University, Tempe, United States, (3) University of New South Wales, Sydney, Australia

Introductory-level science courses introduce students to the discoveries of a particular field and ostensibly promote science literacy. However, the lecture-lab paradigm does not lend itself well to the development of the latter because students do not actually practice applying the scientific process in the classroom or lab setting.

One possible method for improving science literacy outcomes is to better define the scientific process, particularly in terms of day-to-day behaviors. For example, students do not normally "hypothesize", but do observe the world around them and make unconscious assumptions to understand those observations. Our simplified definition of the scientific process includes:

Observation: In our approach, the usage of the generic word "observation" is emphasized over numeric-focused words like "data" or "measurement".

Assumption: Scientists make assumptions in their everyday work (i.e. "assume albedo is 0.3") to simplify it. Here, "assumptions" are emphasized as co-equal to observations in model building.

Model: Here, models are defined as observation-assumption constructs. They can range from assumption-dominated ("hypothesis") to observation-dominated ("theory"). Assumptions are tested and eliminated or replaced by new observations, leading to models with better predictive capabilities over time.

This conceptualization of the scientific process was taught in the Arizona State University online-only astrobiology lab science course Habitable Worlds. Additionally, an in-person course offered at University of New South Wales, Introduction to Astrobiology, is being redesigned to teach topics in this format. Results from ASU's Fall 2018 offering show that students are better able to differentiate between hypotheses and theories in terms of definitions, the level of confidence they should have in each, and to correctly categorize models as hypotheses or theories. We will present results from additional deployments of the method in both the online and in-person versions of the approach.