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The Need for Fieldwork in Science

By Casey D. Allen

A recent special section in *Science* addressed “Grand Challenges of Science Education” (Hines, Merivis, McCartney, & Wible, 2013). Yet aside from one article focused on sexual harassment, each author left out a powerful component in science pedagogy: fieldwork. Though not necessarily the crux of learning or pedagogy at the undergraduate level, fieldwork can, nonetheless, span the gamut of STEM (science, technology, engineering, and mathematics) disciplines like biology, ecology, Earth sciences, engineering, and health sciences. And many instructors in these disciplines include field experiences as integral pieces of their teaching. In two recent articles that analyzed field-based versus in-class performance of over 300 undergraduates, I demonstrated that fieldwork has a strong capacity for increasing both science and nonscience majors’ abilities to learn complex concepts, with the added benefit of actively engaging minority and female students in science (Allen, 2011; Allen & Lukinbeal, 2011).

Although grand field explorations certainly occurred in science’s past (think Humboldt and Powell), fieldwork was often a way to validate (or not) and/or test hypotheses and laboratory-based models. In the 21st century, our grand discoveries now stretch beyond these early endeavors, encompassing deep ocean to deep space. We use amazing technology to conduct experiments like peering into the electromagnetic spectrum, mapping the human genome, studying mineralogy using scanning electron microscopy, and identifying new

universes with powerful telescopes. These data and subsequent findings lead to astounding breakthroughs in science. So why, with all this technology at our fingertips, would we want to potentially put ourselves in harm’s way by gathering data “in the field” and/or using it in our classrooms?

In nearly every instance just listed, no matter the data’s frequency, amount, or resolution, some sort of ground truthing occurred. This is as it should be, as a lack of ground truthing often results in errors and inaccuracies. Many a scientist has been caught in the midst of data misrepresentation, which could have been avoided by ground truthing. How much longer, for example, would the authorities have spent hypothesizing about potential causes and vectors during the London cholera outbreak had John Snow not went into the field and gathered data? What effect did that straightforward act of performing fieldwork have on London’s—and the world’s—health?

In fact, the more I engage students in fieldwork, the more convinced I become that it remains a necessity for science teaching and learning. From a student perspective, based on my own classes and from swapping anecdotes with colleagues inside and outside my department, something changes when a student is actively engaged in fieldwork. They inevitably broaden their worldview, realize they can handle stressful situations, and gain valuable professional skills while simultaneously enhancing their ability to understand their place—not just in science, but the world at large.

Keeping students engaged and enthusiastic when it comes to fieldwork,

however, is not an easy task, especially when both time and money are in short supply. The economy is a shadow of what it used to be, and that includes funding agencies and monies available for fieldwork, whether part of a course or not. Similarly, with more demand on instructors to pursue research agendas, how is time made for fieldwork? When budget shortfalls occur, field trips are often the first cut from programs. But most students relish the chance to not be stuck in the classroom, and even a short field trip around campus can serve as a strong recruiting tool. As stellar instructors know, teaching a subject increases retention and understanding of it, and few places offer the opportunity for students to teach—themselves, classmates, or even the instructor—than in the field. And the act of doing fieldwork implies going back to a site. While in the Amazon with a geomorphologist, pedologist, and botanist, for example, the philosopher Bruno Latour (1999, p. 74, italics in original) noticed that even as they were preparing to leave the field site, his colleagues were “*also preparing to return.*” Serendipitously, they concluded it was necessary for an entomologist to accompany them next time so that they could pursue more in-depth research. They simply had to return.

Social networks, formal or informal, are inherent in fieldwork, and there is a continued voicing of the necessity to conduct inter/multi/transdisciplinary research while, rather ironically, science seems to embrace reductionism. Still, more and more scientists from varying disciplines are realizing the important role these synthesis activities play in generating workable solutions to some of

our greatest problems (Simon et al., 2013). Indeed, the social nature of fieldwork remains a formidable and positive force for science. Just as when instructors engage students in the field, so may those students engage their peers. When a team of scientists ends up in the field, usually productive discussions follow that can lead to new considerations, learning new methods, and eventually discovering new information. In the process of doing fieldwork, learning often happens without trying.

I put forth that one of the best mechanisms for learning, teaching, and doing science well rests in fieldwork. In the end, although those scientists and instructors using and doing fieldwork might believe they have been overlooked, the fact is that fieldwork continues to play just as vital a role now

and in the future as it has in the past. So, when confronted with “grand challenges in science education,” integrating fieldwork into STEM learning and pedagogy seems like a winning combination all around—and especially so when it comes to female and minority students engaging in science. ■

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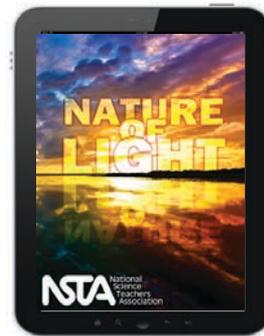
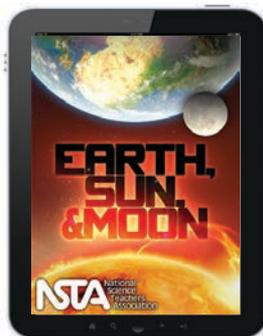
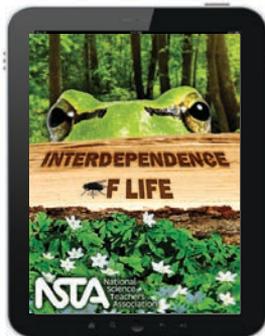
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