W2: KEY TOOLS AND W2: STRATEGIES FOR MAKING AND USING VIRTUAL FIELDWORK EXPERIENCES

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Fieldwork is a signature pedagogy (Shulman, 2005) for the geosciences, but it can be challenging to bring groups of students into the field. Likewise, it can be difficult to replace valuable aspects of fieldwork in settings like large college lecture halls or K-12 classrooms. Virtual Fieldwork Experiences (VFEs) are helpful in meeting these challenges. We do not suggest that VFEs replace actual fieldwork; rather, they can act as a dynamic bridge between field and classroom. In carrying out actual fieldwork and associated complementary VFEs, key questions to consider include:

- What are the most important features and results of fieldwork?
- What aspects can be replicated through the use of multimedia? To what extent?
- How can the creation of VFEs be used to catalyze, extend, document, and share what is learned from doing actual fieldwork?

Over a decade ago, we began developing curriculum materials and offering professional development programming in which VFEs are a key feature. Over the last ten years, both the technologies available and our pedagogical approaches have changed substantially. Technologically, things that used to take hours to create can now be done in minutes, and other things that were simply not practical have become simple for users to create.

The rate of change of pedagogy is slower. Our initial goal of creating VFEs that offer a true inquiry experience by themselves has been tempered over time. While VFEs can offer inquiry experiences for students, a shorter route to inquiry is through student-created VFEs that document fieldwork and learning done by students (Granshaw and Duggan-Haas, 2012).

One of the most important outcomes of our work is the development of a series of questions that can be productively asked and investigated for any site, all supporting the driving question of this work: *Why does this place look the way it does?* The set of questions is included in a virtual fieldwork template in a chapter on fieldwork in each regional volume of *The Teacher-Friendly Guide to the Earth Science of the U.S.* (available free at http://teacherfriendlyguide.org; see, e.g., Duggan-Haas and Kissel 2016).
The effective creation and use of VFEs is dependent upon Technological Pedagogical Content Knowledge (TPACK; see, e.g., Mishra and Koehler, 2006), the suite of understandings and skills that educators apply to teaching scientific content with technology. Educators working with VFEs often find themselves pushing their limits in one or more of the different realms of TPACK. Pushing limits is fundamental to professional growth.

Our work has led to three key ideas for VFE development and use.

- There are scientific and historical questions that can be productively asked and investigated about any site.
- Investigating a landscape is an exercise in Earth systems science – no landscape is the product of a single process.
- Virtual fieldwork is a student-friendly way of documenting, analyzing, and sharing lessons learned from studying a field site.
- And scruffy VFEs are okay. That is, VFEs are always works in progress and can be useful for teaching and learning from early stages of development and without professional-looking design and graphics.

This workshop will introduce a range of technological tools and teaching resources for the creation of VFEs (Duggan-Haas, 2015). Participants will have the opportunity to try out technologies on their own smartphones, tablets, or laptops, as well as explore VFEs we have created. We will explore options that are low-cost or free and that can be mastered by science educators who are not technology specialists. Categories of standard digital tools that together can be used to create a multimedia representation of a field site include the following:

- gigapixel-resolution panoramic images (e.g., Gigapan), made from numerous photos stitched together into one high resolution image, and lower resolution panoramic images (e.g., Google Street View);
- digital 3-D images at multiple spatial scales, including topography (e.g., TouchTerrain) and outcrops and specimens (e.g., Trnio), making them available online (e.g., via Sketchfab), and printing those shapes with 3-D printers;
- field video, time lapse animations, and simple GIF animations;
- digital maps of numerous kinds of spatial data that can be overlain upon each other (e.g., Google Earth, Google Maps, Esri products);
- platforms for sharing multimedia (e.g., Prezi, Esri Story Maps, Powerpoint/Keynote); and
- videoconferencing, e.g., from field to classroom and from classroom to classroom (e.g., Zoom).

Additional information about virtual fieldwork experiences can be found at PRI's website dedicated to the topic of VFEs, http://virtualfieldwork.org. At that site are examples of VFEs that have been created using a variety of media and for a variety of places and purposes.

REFERENCES

Duggan-Haas, D. 2015, About making Virtual Fieldwork Experiences: Resources from the ReaL Earth Inquiry project and the Critical Zone Observatory network, Prezi-style presentation for the Shale Hills RET/REU Program, Summer 2015, https://prezi.com/fvs9pabda-te/about-making-virtual-fieldwork-experiences-resources-from-the-real-earth-inquiry-project-the-critical-zone-observatory-network/?utm_campaign=share&utm_medium=copy&webgl=0

Duggan-Haas, D., and Kissel, R. A., 2016, Real and Virtual Fieldwork: "Why Does This Place Look the Way it Does?", In: Swaby, A. N., Lucas, M. D., and Ross, R. M. (Eds.). *The Teacher-Friendly Guide to the Earth Science of the Southwestern US*. Paleontological Research Institution (Special Publication 51), Ithaca, NY, pp. 373–395.

Granshaw, F. & Duggan-Haas, D., 2012, Virtual Fieldwork in geoscience teacher education: Issues, techniques, and models, In: Whitmeyer, S.J., Bailey, J. E., De Paor, D. G. , and Ornduff, T. (Eds.), *Google Earth and Virtual Visualization in Geoscience Education and Research*, Geological Society of America Penrose Special Paper 492, Boulder, CO, pp. 285-303.

Mishra, P., and Koehler, M., 2006, Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge, *The Teachers College Record,* v. 108, no. 6, pp. 1017–1054.

Shulman, L.S., 2005, Signature Pedagogies in the Professions, *Daedalus,* v. 134, no. 3, pp. 52–59.