

Bringing Knox County into the Classroom: Virtual Field Trips for Kenyon's Earth Sciences Offerings

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Background and motivation

For many earth scientists, field experiences have been foundational to their careers. Through field experiences such as course field trips, fieldwork, and field schools, students become engaged in the discipline, develop marketable discipline-specific skills, and maintain their enthusiasm and motivation. Indeed, learning in the field has been described as one of the four key aspects to how geoscientists think (Kastens et al., 2009). Kastens and others argue that students develop 'professional vision' during field experiences - allowing them to remove visual noise and focus on features that earth scientists use to reconstruct Earth's history. In addition, it is often in the field that students practice the first step in a 'cascade of inscriptions' - transforming information directly from nature into recorded observations in a field notebook (Kastens et al., 2009).

Although field experiences are considered by many to be critical to the development of earth scientists, they can present a barrier to many students, resulting in the perception that earth science is a field only for outdoorsy and non-disabled students (Gilley et al., 2015). For students who cannot attend class field trips, alternative assignments such as research papers often seem like a punishment rather than an equally valuable learning experience. Due to Covid-19, field experiences beyond Kenyon's campus may not be possible for any students due to current transportation restrictions (one person per vehicle). If restrictions change and we are able to transport multiple students in a van, there will undoubtedly be students who are unable to leave campus or who are enrolled remotely.

Reading the Ohio Landscape (ENVS 191) is a first-year special topics seminar that Ruth is currently developing with the intent to turn it into a permanent ENVS offering. The overall vision for the course is to introduce students to the geologic processes that have shaped the Knox County landscape, and to help students develop a sense of place in their new home. Throughout the course, there is a strong emphasis on field observations and using those observations to recognize patterns, generate scientific questions, and propose alternative hypotheses. Geology (PHYS 108) is a non-major introduction to the geosciences designed for all students with no prerequisites. Eric has offered this course many times, and an off-campus field trip has always been a critical component of the course - an opportunity for students to apply classroom learning to the real world, and a crucial assessment opportunity for Eric to gauge student progress. For both courses, we feel strongly that the lack of field experiences due to Covid-19 restrictions would put both students and instructors at a severe disadvantage.

Although there is plenty that can be observed on the Brown Family Environmental Center property, access to high-quality rock outcrops is very limited within walking distance of campus.

The purpose of this Course Improvement proposal is to create a number of virtual field trips that will allow students to interact with local sites of geologic interest when they are unable to do so in person - whether due to the current Covid-19 pandemic or due to disability, illness, or scheduling conflicts. While the virtual field trips are being developed with ENV5 191 and PHYS 108 in mind, the field trips could be easily adapted for use in any of Kenyon's current and/or future earth sciences offerings, and could be used as outreach tools to engage with community members through BFEC programming or events with local organizations and schools.

Course Innovation Plan

Virtual field trips have been developed and implemented successfully by many instructors and can even result in more effective learning experiences than actual field trips (Zhao et al., 2020). Virtual field trips can take many different forms, including still photos and high-resolution panoramas, 360-degree video, 3-dimensional models, and fully-immersive virtual reality experiences. Although the fully-immersive virtual reality experiences can offer impressive interaction, the technology required is prohibitive. Virtual field trips experienced through 2-dimensional screens can be just as effective learning experiences as the immersive experiences (Zhao et al., 2020).

We plan to use 360-degree video and digital 3-dimensional models (created using Structure-from-Motion photogrammetry) to create virtual field trips for 2-3 rock outcrops in or near Knox County. Potential locations include Honey Run Regional Park, Blackhand Gorge State Nature Preserve, and outcrops of Blackhand sandstone and Wooster shale outside of Mansfield and Loudonville. 360-degree video allows users to look in all directions and can be used with VR viewers (such as the inexpensive Google Cardboard viewers that work with a smartphone) or a standard 2-dimensional screen. The 360-degree videos will serve as introductions to the field sites and will include some narration to point out important features. With Structure-from-Motion photogrammetry, a technique Ruth used during her Ph.D., Ruth will create digital 3-dimensional models of 1-2 of the rock outcrops that students will be able to explore independently on their personal computers. These 3-dimensional models will be uploaded to Sketchfab, a platform that will allow us to easily share the digital content without requiring students to download any additional software.

In addition to the development of the 360-degree video and the digital 3-dimensional models, we will also develop instructional content that will guide students through the virtual field trips.

Assessment Plan

In collaboration with Erika Farfan of Institutional Research, we will develop a brief assessment for students to complete after virtual and actual field trips, with the aim of measuring how learning outcomes compare across instructional modes. These surveys will include questions about students' confidence and identity as scientists (*I feel confident about my ability to make*

geological interpretations), as well as their sense of belonging within the earth sciences (*Earth Science is a discipline I can imagine pursuing in the future*).

Although this year, the assessment may only be completed by students who experience the virtual field trips, the survey will be designed such that all students can take the survey in future years, regardless of the mode of field instruction. This will allow for comparison between students who have experienced the virtual field trips and those who experienced the actual field trips.

Budget (total requested: \$4500)

Personnel (total \$2000)

Ruth Heindel stipend for 2-week commitment (\$100/day).....	\$1000
Eric Holdener stipend for 2-week commitment (\$100/day).....	\$1000

Equipment (\$1300)

360-degree camera (GoPro Max).....	\$550
360-degree camera accessories.....	\$200
Google Cardboard VR viewers (35*).....	\$550

*This number would provide a VR viewer to each student in ENVS 191 (cap: 11) and PHYS 108 (cap: 24), allowing for students to keep the viewers with them in case of a campus shutdown. In the future, this library of viewers could be used by the ENVS program as well as other departments that may want to use VR technology.

Software (total \$1200)

Agisoft Metashape educational license (x2*).....	\$1200
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*Agisoft Metashape educational licenses are one-time purchases that are tied to individual computers. Purchasing two licenses would allow both Ruth and Eric to use the software. If there is additional interest in Agisoft Metashape, there are educational floating license packages that could be moved freely among computers.

Report

We, Ruth Heindel and Eric Holdener, commit to writing a brief report on the project and presenting our work at the Inclusive Excellence Progress Retreat.

References

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