



# Developing Multidisciplinary Immersive Virtual Geoscience Field Trips at Weber State University in Ogden, Utah

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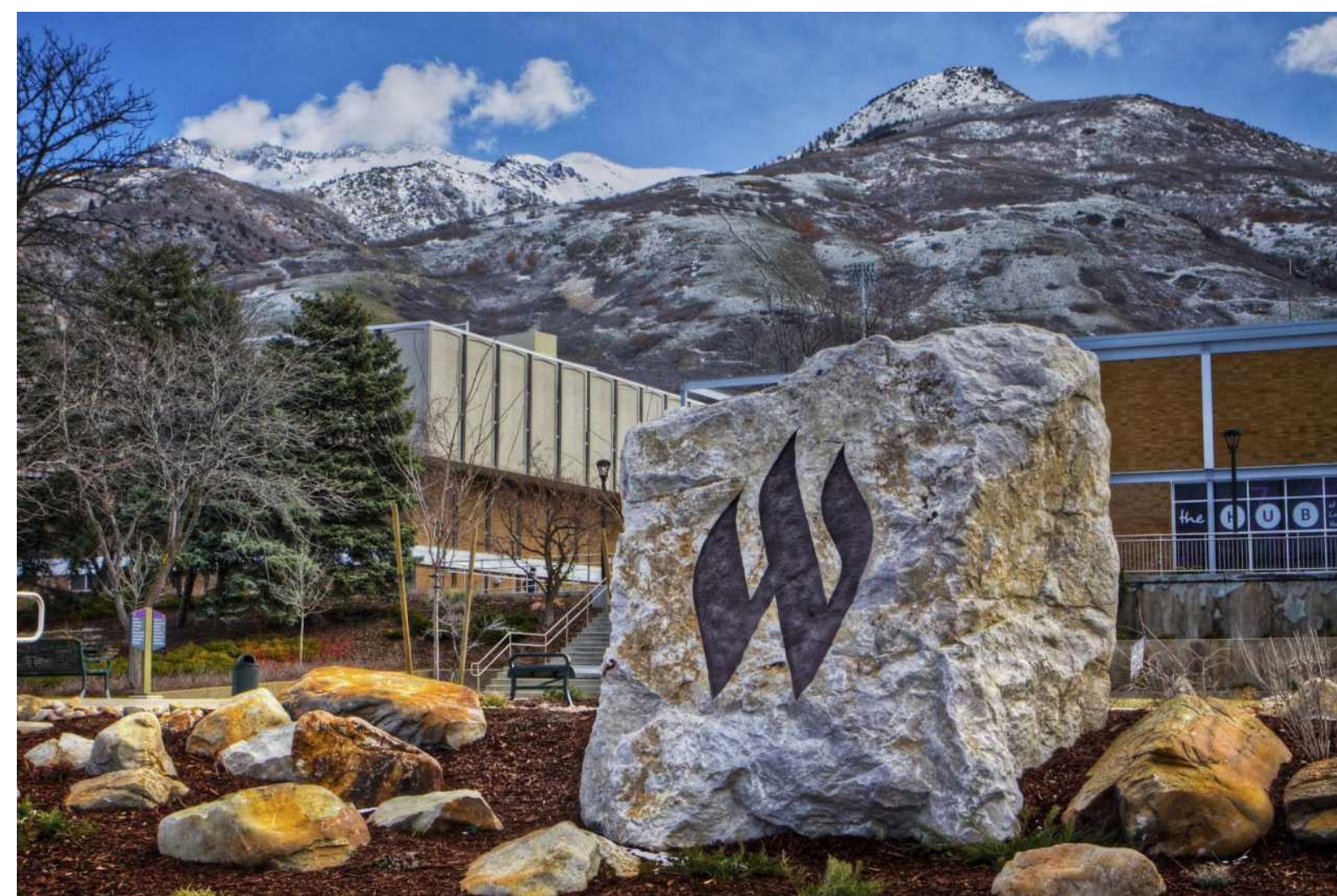
## Abstract

Field trips provide high-impact learning experiences and are critical components of many Earth science courses. Field trips also mimic conditions students may face in future careers. Field experiences, including physical sensations, improve retention, help train students to work effectively in teams and plan complex tasks, and build strong bonds among students and faculty. However, field trips also present challenges to student accessibility, and to social distancing during the COVID-19 pandemic. Therefore, the Department of Earth & Environmental Sciences (EES) at Weber State University (WSU) has developed multiple immersive virtual field trips (iVFTs) to supplement and partly replace in-person learning for the Fall 2020 semester, and increase student accessibility in future semesters. The EES Department has four upper-division courses with integral field trips scheduled for Fall 2020 (Geomorphology, Structural Geology, Geomicrobiology, and Geoscience Field Methods). These courses are required courses for majors, and Field Methods is a capstone course that focuses on building skills that prepare graduates for graduate programs and the workforce. Faculty have prepared for a contingency where all instruction will be remote, along with having hybrid courses in which iVFTs are integrated with, rather than completely replacing, field components. Faculty, working in collaboration with the Creative Academic Technology Solutions team at WSU, have made video lectures in the field with live demonstration of measurement techniques, collected 360 degree spherical images using an automated camera mount, and are building 3-D point cloud representations of outcrops for fifteen separate field trips at twelve different locations along the Wasatch Front and Great Salt Lake in northern Utah. Images and videos are also being combined with geochemical, structural, and petrologic data sets within the iVFTs to provide an enhanced learning experiences. Content and lessons learned from student interactions with iVFTs will be shared with the broader geoscience community.

## Institutional Profile and Motivation

### Weber State University

Weber State University (WSU) is an open-enrollment, dual-mission institution offering a wide range of baccalaureate degrees, while also meeting regional community-college needs with associate degrees (26,809 students). WSU is located in Ogden, Utah in the northern Great Salt Lake Valley. Students here are more likely to be first-generation college students, work full time, receive financial aid, and need remediation in math than students at research universities. WSU prides itself on providing an affordable (\$5712/year) student-centered education, while focusing on three core themes of Access, Learning, and Community.



### Motivation

COVID came on rapidly in March of 2020, causing most universities to shut down that spring and dramatically shift their offerings to more online and virtual content. We have four upper-level, required Earth Science courses that are offered in the fall each year with required field trip components that we were unsure of how we would offer. The goal of this project was to create virtual field trips that could be used in place of or in addition to in person field experiences. We hope to use these virtual option to increase accessibility to our field trips in the future. We have been able to do field trips in person this semester, so all data collected is with supplemental virtual trips.

## Funding and Equipment

In response to difficulties associated with moving curriculum online due because of COVID, Weber State put out a special call for technology improvement grants. At the same time Field Camp Directors were meeting weekly through a GSA and NAGT sponsored webinar series to address teaching field courses remotely. Many people helped with equipment recommendations and discussions about the amount of time and utility of various types of online content. The Earth & Environmental Science Department decided jointly that creating immersive virtual field trips would be the best option for the majority of our field trips. None of this would have been possible without the huge amount of support from the WSU Creative Academic Technology Solutions group who recommended hardware and software and then spend many hours teaching EES faculty and students how to properly use it. They have also been instrumental in editing videos, images and creating the tours themselves.

**Equipment**  
Canon DSLR Camera  
GigaPan Epic Pro Camera Mount  
Tripod  
Microphones  
Backpack  
ND and UV protective filters  
Hard drives and extra batteries

**Software**  
Pano2vr tour creation software  
Adobe lightroom, premiere, and photoshop  
PTGui photo stitching software

**Total Cost ~ \$3300**



## Field Trip Locations and Workflow

We have 15 separate locations we knew we needed to photograph to cover the trips we would generally run during the fall semester. These trips were for multiple courses including: Historical Geology - GEO 1220, Geomorphology - GEO 3150, Structural Geology - GEO 3060, Geomicrobiology - GEO 3753 and Field Methods - GEO 4060, taught by 5 different instructors. Once we started we realized we should also create virtual tours for our general education classes and to share with local high school teachers.

Geologically speaking, we are incredibly lucky with our location on the edge of the Wasatch Mountains in the Great Salt Lake Basin. All trips were within an hour +/- of the Weber State campus, and field work was completed over the course of 8 weeks in July and August.

Some tours only had 1 or two locations within them, others had up to 57. For each location we collected a 360 image and generally shot at least one video.

### Workflow

Field planning included determining how many sites we needed to shoot for any given field trip. The 360 images look better if they have people in them, so I convinced a number of my current and past students to come meet me in the field and get personalized tours of their favorite field trips :) Short trips took 2 hours, some took multiple days. The camera and mount could maintain battery for about 7 hours of almost straight shooting the 360 images. Making videos drained the camera battery much quicker. We carried extra camera, mount, and microphone batteries.



### Generating High Resolution 360 Images

Setting up the camera, mount, and tripod to take the 360 images takes between 15 and 20 minutes per location. If the trail was mellow, we could carry the mount and camera on the tripod between locations.

The camera must be on manual focus and you need to set the lighting to find a good average between the darkest and lightest parts of your 360 (can be touched up).

We shot all 360 images between 10 AM and 5 PM for consistent lighting.



### Generating Videos

We tried to have one or more videos for each 360 location to explain what students should be focusing on and noticing at each spot. Videos were tailored for specific courses. Sometimes we did multiple takes at a single location for multiple tours (upper-level vs intro).

We generally tried to shoot videos in the morning or evening, when the lighting was less harsh. To make it more realistic we generally did the trip in order shooting videos and then worked our way back doing the 360 images. It's much more efficient not to switch back and forth at each location (because of variable camera settings and different mounts).



## Building the Virtual Tours and Functionality

Each day, when we returned from the field, all batteries were charged and SD cards removed. The trip was broken down into stops and each stop would have the 48-55 pictures to make the 360 image, videos, audio and any detailed pictures. Those were all uploaded to an external drive and shared with our Creative Design support team via Google Drive.

To create the 360 images all pictures were pulled into Lightroom together and any changes to the brightness/lighting was applied to all images. Then the 360 images were stitched using the PTGui software program. Sometime, following stitching more editing was needed and the stitched image would be brought into Photoshop for any final edits.

The tour nodes are then pulled into the Pano2VR software to start building the tour. Once all the 360s are in, they need to be located and oriented. Then videos, detailed images, and more information can be added to any specific tour location. Videos were edited and then uploaded to YouTube to save file space within the tours (also allows for easier editing).



In multi-stop tours students can either navigate by clicking on previous or next locations within their field of view, or they can use the map (upper left in upper picture) to move from one place to another. The zoom in the 360 images allows students to do rock descriptions simply by zooming in on the image. Embedded videos and detailed pictures (to show fossils or grain size changes) can be found within the images. Some tours are linked to each other (e.g. Spiral Jetty to Antelope Island). Right now there are no embedded assignments, so students work through questions or problems in a separate program.



## Examples of Tours

Please follow the links on the right side of this box to check out the tours.

We are still working to update all tours with videos, extra data and information. The links should stay consistent through updates so they may change if you come back to them in the future. Feel free to let me (elizabethbalgord@weber.edu) know if you have any comments. Once the associated assignments are linked to the tours we plan to share as many of these tours as possible via Teach the Earth on the NAGT/SERC webpage.

### Field Methods

North Ogden Divide - surficial mapping - [http://tour.weber.edu/EES/North\\_Ogden\\_field\\_trip/](http://tour.weber.edu/EES/North_Ogden_field_trip/)  
Echo Canyon - sedimentology - [http://tour.weber.edu/EES/Echo\\_Canyon/](http://tour.weber.edu/EES/Echo_Canyon/)  
Emigration Canyon - bedrock mapping - [http://tour.weber.edu/EES/Emigration\\_Canyon/](http://tour.weber.edu/EES/Emigration_Canyon/)

### Structure

I-84 Road Cut - minor fault/fracture analysis - [http://tour.weber.edu/EES/I-84\\_roadcut/](http://tour.weber.edu/EES/I-84_roadcut/)  
Park City - minor fault/fold/fracture analysis - [http://tour.weber.edu/EES/Park\\_City/](http://tour.weber.edu/EES/Park_City/)

### Geomorphology

Campus Surveying - learning to survey - [http://tour.weber.edu/EES/campus\\_survey/](http://tour.weber.edu/EES/campus_survey/)  
Weber River - surveying across a river - [http://tour.weber.edu/EES/Weber\\_River/](http://tour.weber.edu/EES/Weber_River/)  
Ogden Cemetery - chemical weathering - [http://tour.weber.edu/EES/Ogden\\_cemetery/](http://tour.weber.edu/EES/Ogden_cemetery/)  
22nd St Trailhead - alluvial fan - [http://tour.weber.edu/EES/22nd\\_street\\_fan/](http://tour.weber.edu/EES/22nd_street_fan/)

### Geomicrobiology

Spiral Jetty - basalts, chemical sediments - [http://tour.weber.edu/EES/Spiral\\_Jetty/](http://tour.weber.edu/EES/Spiral_Jetty/)

### Historical Geology

Antelope Island Frary Peak - basement rocks and snowball Earth - [http://tour.weber.edu/EES/Antelope\\_Island\\_FP/](http://tour.weber.edu/EES/Antelope_Island_FP/)

Antelope Island Buffalo Point - deformed Paleozoic and modern lake sedimentation - [http://tour.weber.edu/EES/Antelope\\_Island\\_BP/](http://tour.weber.edu/EES/Antelope_Island_BP/)

### General Education

Campus Fault Scarp - Wasatch fault introduction - [http://tour.weber.edu/EES/campus\\_scarp/](http://tour.weber.edu/EES/campus_scarp/)  
Discovery Loop - local geologic hazards - coming soon

## Assessment

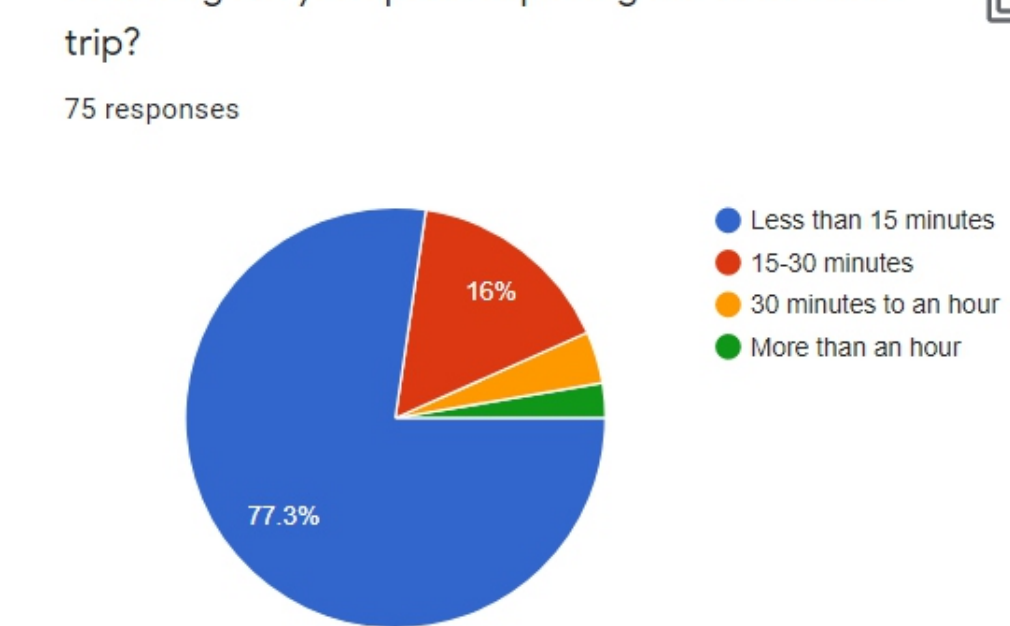
We have two different types of tours,

1. tours we generated for our upper-level students that we hope will just supplement in person trips.
2. Tours designed for our general education courses where we do not usually have an in person field trip.

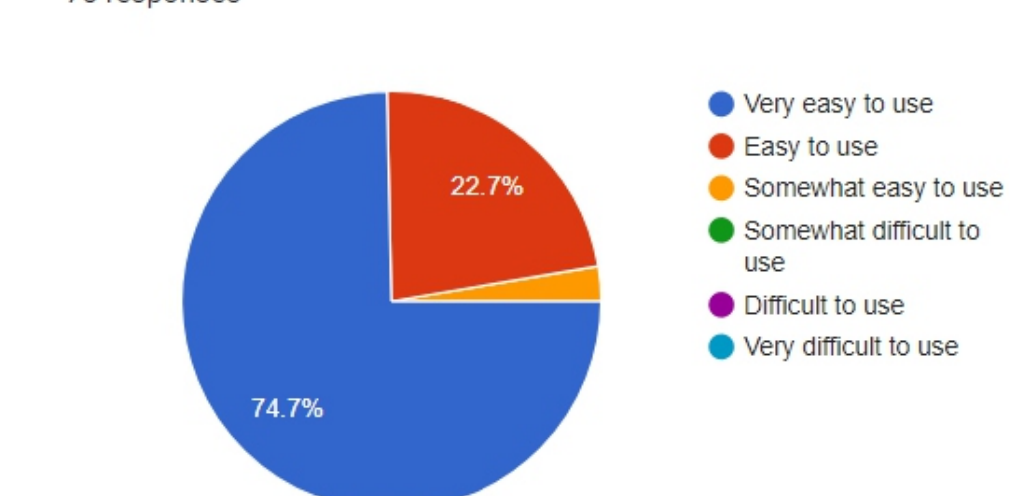
Currently we are in the good situation where our upper-level students have been able to participate in field trips in person so tours have been supplemental to trips. Generally, students have really liked having the tours to reference and I have enjoyed using them in class when I'm trying to talk them through issues they may have had with their maps. It really helps to be able to show them the location/outcrop I am talking about.

The virtual tours are a new addition to our general education courses and we are excited to see student reactions to them. Students will be completing pre and post virtual trip surveys to determine if the tours help with comprehension of concepts and with recruitment.

How long did you spend exploring the virtual field trip? 75 responses



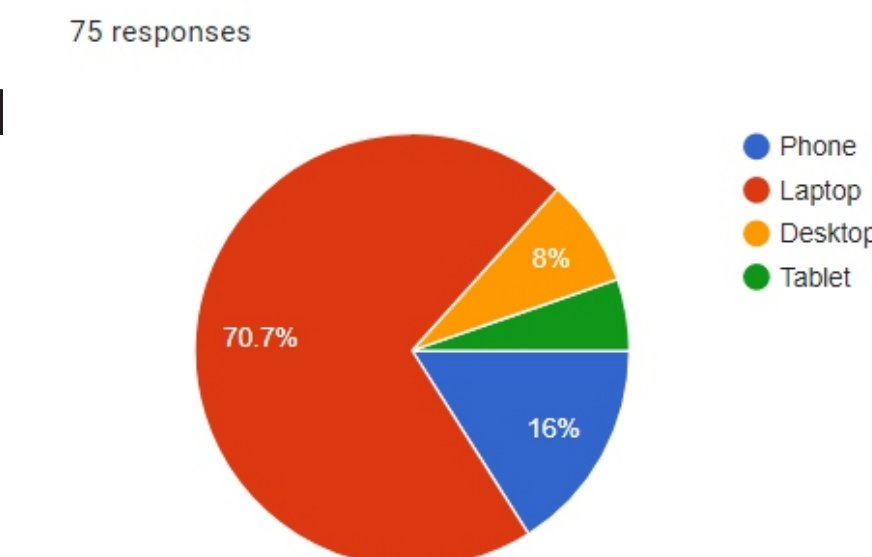
What was your experience navigating through the virtual field trip? 75 responses



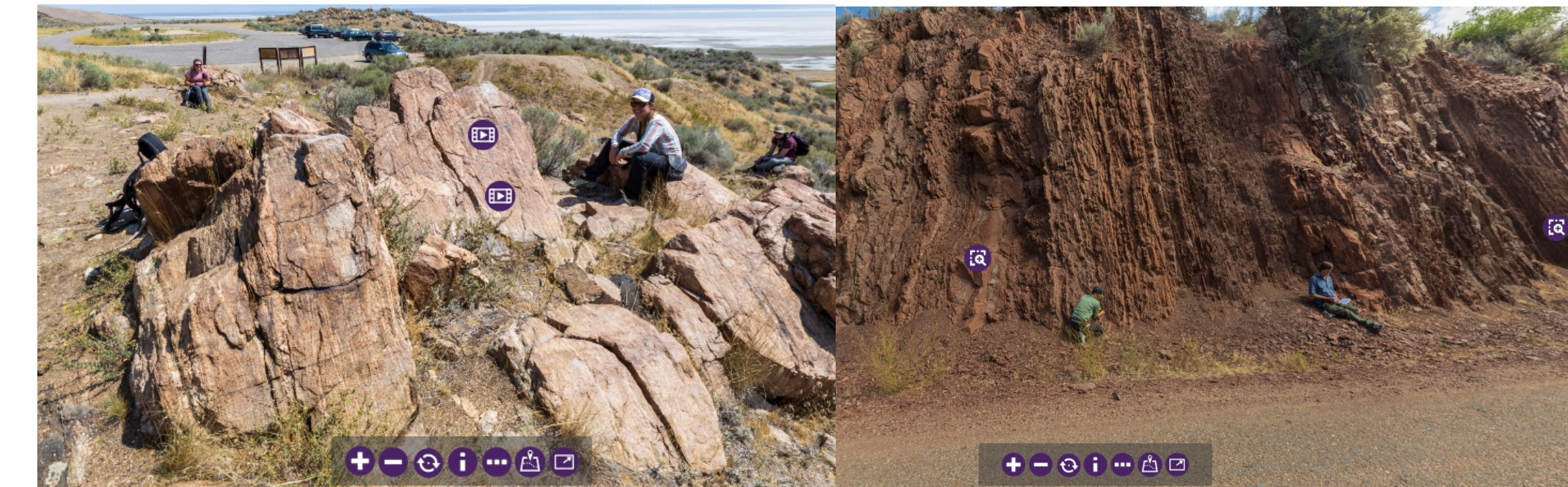
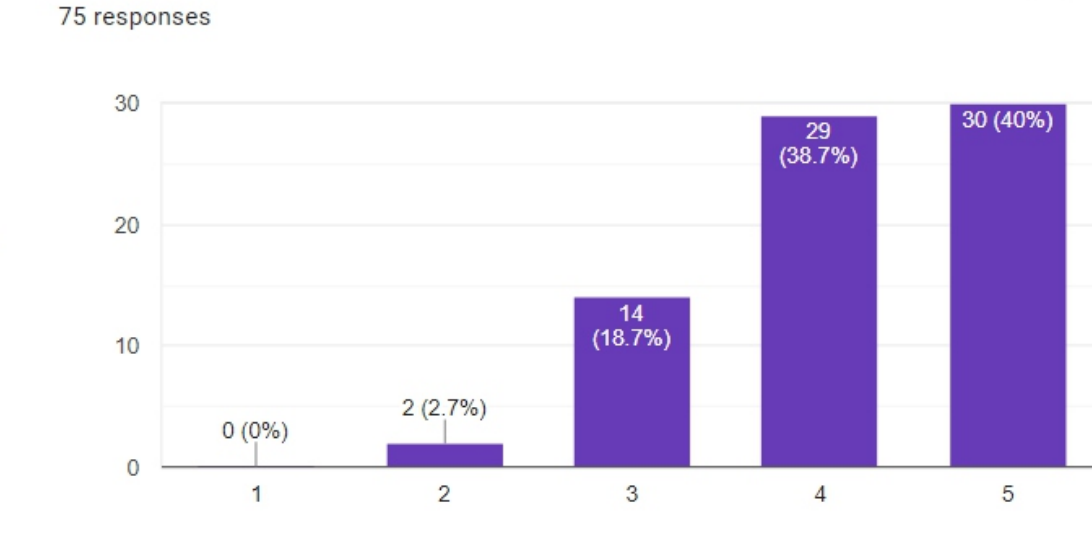
## Preliminary Conclusions and Future Work

Students have had consistently positive reactions to the virtual tours both as supplemental materials and as the only field experience they are getting in a course. At this point we do not have the pre and post surveys from the large-scale general education surveys, but we look forward to seeing them.

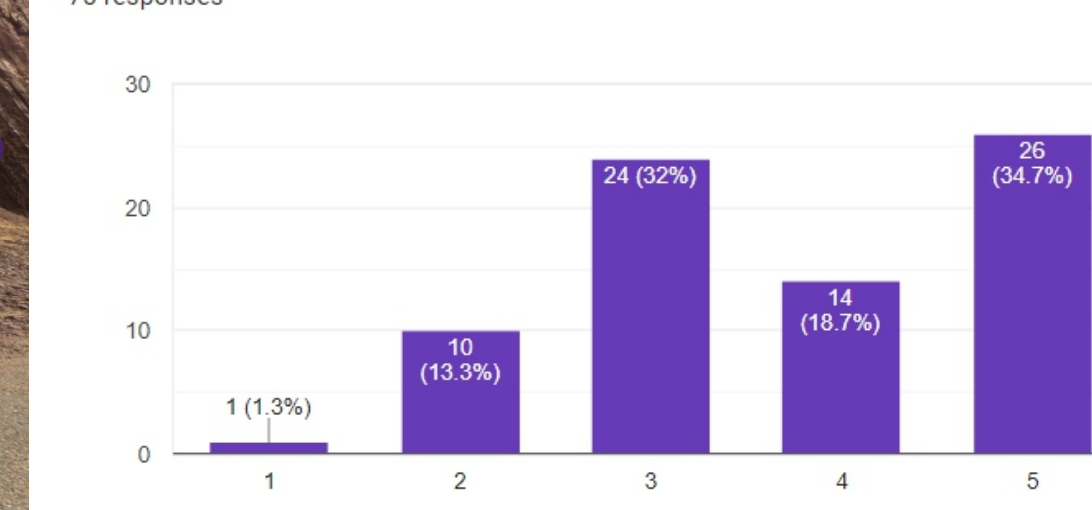
How did you access the virtual tour? 75 responses



The virtual field trip experience is valuable. 75 responses



Given the opportunity, I would prefer to participate in an in-person, instructor-led field experience 75 responses



## Acknowledgements

•This work was supported by NSF EAR 1801760, a Special Call Technology Grant from Weber State University's Research, Scholarship & Profession Growth Committee, and the Department of Earth & Environmental Sciences  
•Multiple students, specifically James Henderson, joined faculty to help make the virtual trips.  
•The Weber State Creative Academic Technology Solutions (CATS) Group trained faculty and students on how to use hardware and software. They also made equipment recommendations and have been doing the digital work to edit photos and videos and build tours.  
•Ideas, support and incredible examples of virtual content came from the GSA/NAGT webinar series: Using Digital Field Tools for Remote Teaching and the NAGT Earth Educators Rendezvous Teaching your Upper-Level Course Online Workshop