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. Due to COVID-19, many institutions of higher education have been forced to adapt and find creative ways to adapt their teaching approach. This has been particularly challenging for field trips, which are an important pedagogical tool for teaching Earth science. Many institutions have turned to virtual field trips (iVFTs) to supplement and partly replace in-person learning for the Fall 2020 semester, and Earth & Environmental Sciences (EES) at Weber State University (WSU) has developed multiple immersive virtual field trips to augment the teaching of four upper-level, required Earth Science courses that are typically taught with in-person field trips. Field trips provide high-impact learning experiences and are critical components of many Earth science courses. Due to COVID-19, many institutions of higher education have been forced to adapt and find creative ways to adapt their teaching approach. This has been particularly challenging for field trips, which are an important pedagogical tool for teaching Earth science. Many institutions have turned to virtual field trips (iVFTs) to supplement and partly replace in-person learning for the Fall 2020 semester, and Earth & Environmental Sciences (EES) at Weber State University (WSU) has developed multiple immersive virtual field trips to augment the teaching of four upper-level, required Earth Science courses that are typically taught with in-person field trips.

Institutional Profile and Motivation
Weber State University
WSU is an (emphasis) regional, land-grant institution offering a wide range of undergraduate, graduate, and professional development opportunities in all fields of study, with a particular emphasis on meeting the needs of the northern Great Salt Lake Valley. Students enter from more than 100 different countries, representing IB, AP, and non-traditional students. The Department of Earth and Environmental Sciences serves about 300 students each year and has a staff of 15 faculty members. Weber State has a dual-mission institution offering a wide range of undergraduate and graduate programs, including a strong emphasis on work, student services, and leadership activities. The Geoscience Department at Weber State University (WSU) offers a range of undergraduate programs, including a Bachelor of Science in Geology and a Bachelor of Science in Environmental Science.

Motivation
The goal of this project was to create virtual field trips that can be used as a tool to teach students about geology using immersive technology. Our motivation was to create virtual field trips that can be used as a tool to teach students about geology using immersive technology. We hope to use these virtual field trips to increase accessibility to our field trips in the future. We have been able to use fieldwork as a teaching tool, and we are collecting data that will be used in collaborative virtual events.

Building the Virtual Tours and Functionality
In multiuser tours, students can either navigate by clicking on clickable points on the map that lead to a webpage where they can find more information or by clicking on the map itself to view an interactive map with the ability to zoom into specific locations. The tour nodes are then pulled into the Pano2VR software to be located and oriented. Then videos, detailed images, and 360 images are combined to form the virtual tour.

Examples of Tours

Field Methods
1. Campus Fault Scarp - Wasatch fault introduction - Ogden, UT
2. Spiral Jetty - basalts, chemical sediments - Great Salt Lake, UT
3. Park City - minor fault/fold/fracture analysis - Park City, UT
4. Weber River - surveying across a river - Ogden, UT

Assessment
The virtual tours are a new addition to our geoscience education courses and are expected to use student feedback to examine whether they are successful in providing the same level of instruction as the in-person field trips. We are testing the virtual tours with students in the Fall 2020 semester and are collecting feedback to determine if they help with comprehension of concepts and reduce costs.

Preliminary Conclusions and Future Work
Students have not consistently gained the same level of knowledge from virtual field experiences as they gain from in-person field experiences. Future work could include further investigation into the effectiveness of virtual field trips and how they can be used to supplement traditional education courses where in-person field trips are not usually available.

Acknowledgements
The authors gratefully acknowledge the contributions of the following individuals: teaching assistants, field trip instructors, and students. We also acknowledge the support of the Western States Section of the Geological Society of America, the Utah Geoscience Teachers Association, and the Geoscience Education Network.

Fundraising and Equipment

In response to the current situation with the COVID-19 pandemic, many institutions of higher education have been forced to adapt and find creative ways to adapt their teaching approach. This has been particularly challenging for field trips, which are an important pedagogical tool for teaching Earth science. Many institutions have turned to virtual field trips (iVFTs) to supplement and partly replace in-person learning for the Fall 2020 semester, and Earth & Environmental Sciences (EES) at Weber State University (WSU) has developed multiple immersive virtual field trips to augment the teaching of four upper-level, required Earth Science courses that are typically taught with in-person field trips.

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Software

- Adobe Lightroom: image editing software
- Photoshop: image creation software
- Pano2VR software: virtual reality software

Total Cost ~ $3300

Field Trip Locations and Workflow

Field trips are an important pedagogical tool for teaching Earth science. Many institutions have turned to virtual field trips (iVFTs) to supplement and partly replace in-person learning for the Fall 2020 semester, and Earth & Environmental Sciences (EES) at Weber State University (WSU) has developed multiple immersive virtual field trips to augment the teaching of four upper-level, required Earth Science courses that are typically taught with in-person field trips.

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