Increasing Student Engagement in Online Education with Virtual Field and Lab Experiences

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Abstract

In online education, student-to-student interaction can be an important component to encouraging independent thinking and achieving learning objectives. The course development team for "Minerals and Human Health" will share experiences in designing and implementing a virtual laboratory and collaborative projects for this online course. The first of its kind to be offered fully online, "Minerals and Human Health" encompasses the study of interactions between people and earth's mineral resources, and how these interactions are influenced by a variety of natural, human health-related, economic, cultural and political factors. The virtual laboratory takes students on a virtual field trip to abandoned gold mines in the Mojave Desert, where students are able to observe images of samples provided from an electron microscope that the development team extracted for analysis. Using advanced recording techniques, stabilized body cameras, aerial drone footage, macro videography and wireless microphones, the team created a simulated field geologist experience, including footage of having narrowly escaped a massive desert dust storm. The virtual laboratory continues with a sequence of interactive videos where students are introduced to surveying and extraction from the field, lab equipment, and methods for analyzing and identifying mineral particles in dust samples. After learning principle concepts, students prepare an home-project called "The Air we Breathe". In this collaborative project, students interact with each other via online discussion forums and video conferencing in order to collect dust particles for lab analysis. Students deliver the samples for study under optical and electron microscopes to the instructor, who distributes the results back to the students. Students then present their interpretation of the findings. Students are astonished to discover the air that they breathe every day includes hazards such as PM0.5-0.2 that are classified as carcinogenic materials. Initial student feedback has been collected throughout this newly developed course to identify areas that were most impactful and that could be improved for future iterations. Join us as we share our lessons learned while creating this extraordinary online learning experience.

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Minerals & Human Health

GEO 007

Course Design

This undergraduate-level course has dual learning goals: (1) to gain knowledge of the physical and chemical processes dealing with systems where rocks and minerals interact with the hydrosphere, atmosphere, biosphere and human activity associated with exploitation and utilization of Earth's resources; (2) to develop research skills in data collection from environmentally damaged areas, analytical measurements of mineral particles with the aid of microscopic and spectroscopic techniques for evaluation of adverse effects of hazardous Earth materials and their concentrations in air, water and food for the safe consumption and public health.

Virtual Laboratory

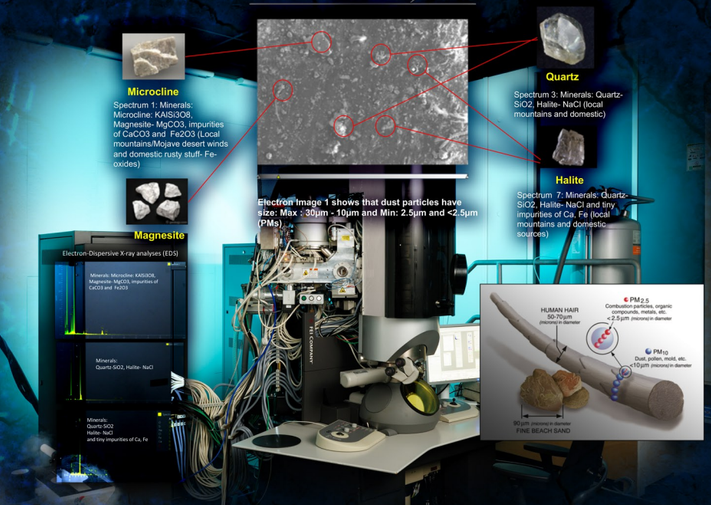
The virtual laboratory focuses on optical microscopy and guides students through the process to identify minerals in the samples collected from the field in the virtual field trip.

Virtual Field Trip

More than 40,000 abandoned mines left a toxic legacy in California since the Gold Rush of 1849. In the past both mining and mineral processing did not have today's environmental standards. During the historical mining activities millions of tons of waste rock and mill tailings were discharged to the land and waters of California. Over time toxic substances such as arsenic, mercury, lead and others were released into the land through natural processes, continuing to be hazardous for humans and the environment. Our task was to visit the abandoned War Eagle Mine in Tecopa, CA and show you step by step how rocks and minerals are collected in the field, and later are brought to laboratories to determine if they are potentially hazardous.

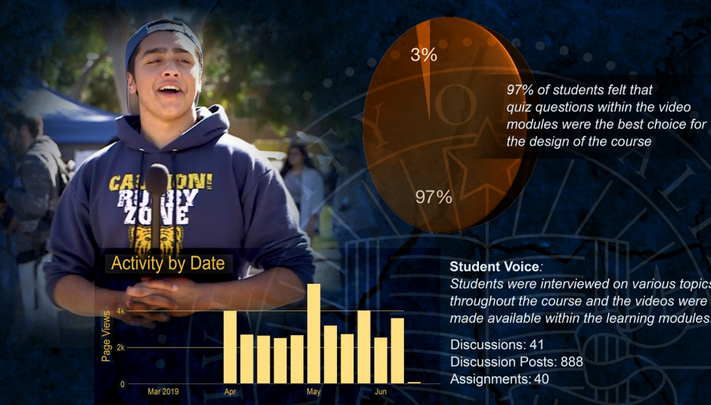
DAY 2: SHOSHONE, CA

Home Project



Students worked in teams to collect dust samples from their local environment. The samples were delivered to the UCR lab for analysis with a scanning electron microscope and the results were distributed to the students. The students then interpreted the results and prepared group presentations to disseminate the data.

Student Feedback



97% of students felt that quiz questions within the video modules were the best choice for the design of the course

Student Voice:
Students were interviewed on various topics throughout the course and the videos were made available within the learning modules.

Discussions: 41
Discussion Posts: 888
Assignments: 40

What did you like most about the course?
"Flexibility, the information felt valuable and important to my life outside of academia."

Thanks to all involved in the production of this course including: Larissa Dobrzhinetskaya, Bethany Ewers-Felix, Brian Bales, Chantal Eyong, Harley Grow-Hernandez, Jaron Land, Paul "The Voice" Gibson, David Oglesby, Charles Alpers and Nate Wildes

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University of California Office of the President

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