Project explores how virtual reality can help students learn

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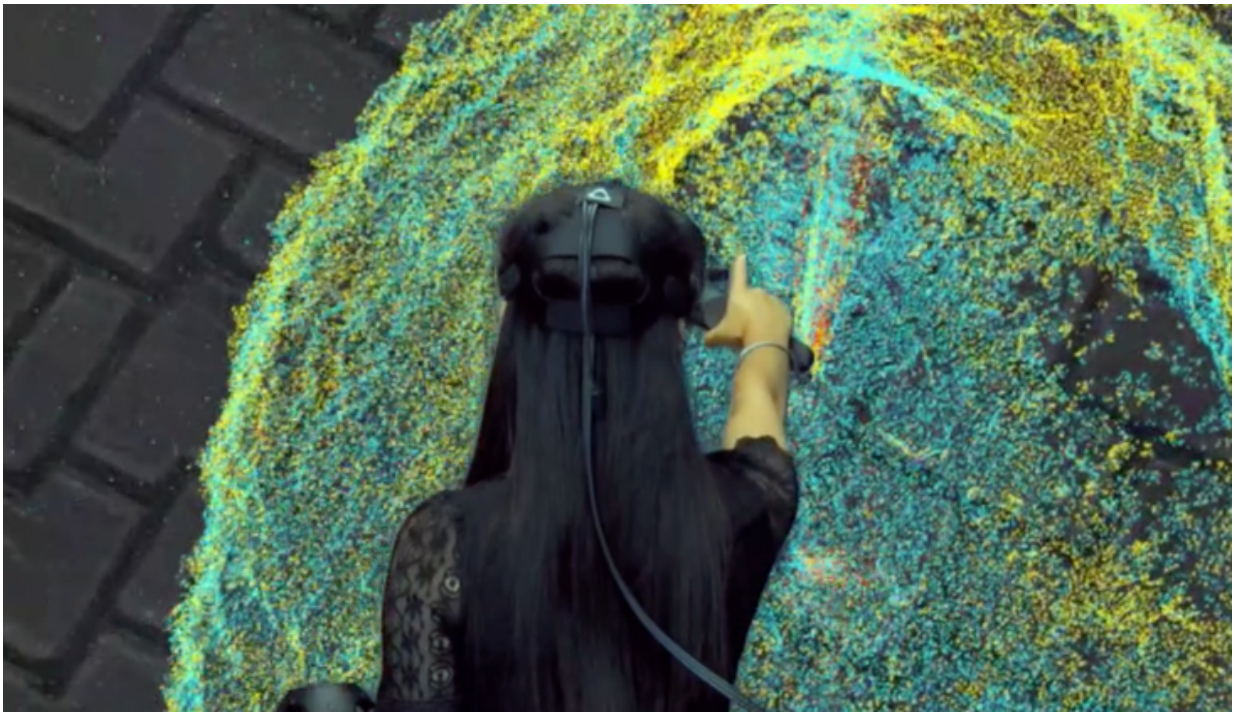

Fangcao Xu, a Ph.D. candidate in geography, explores the dormant Iceland volcano, Thrihnukagigur, using a virtual reality head-mounted display and controllers. Credit: Penn State

Any Trekkie (a fan of Star Trek) knows what the fictional holodeck is: a virtual reality space where people can experience representations of real or imaginary environments and situations for recreation, training, or solving problems. At Penn State, researchers are offering prototype

versions of immersive Virtual Reality (iVR) lessons in three courses this fall and spring to engage students in the advantages and promises that such learning offers.

A multi-disciplinary research team, led by Alexander Klippel, associate professor of geography, and including members from the departments of Geography and Geosciences, the Stuckeman Center for Design Computing, and the John A. Dutton e-Education Institute, received a Research Initiation Grant from Penn State's Center for Online Innovation in Learning (COIL). Their proposal is titled "Immersive Virtual Reality (iVR): The Printing Press of the 21st Century and How Learning About Place and Space will Never be the Same."

"iVR means a reality you can create," Klippel explained. "It allows you to be present in a scene perceptible by the senses. Head-mounted displays such as the Rift by Oculus or the Vive by HTC allow for a fully immersive experience including vision, sound, touch (with special controllers and gloves), and even smell, in some cases."

Here's how it works: You slip on the display goggles and enter a virtual launching chamber, defined by a blue grid. Say you're going to explore the dormant Iceland volcano, Thrihnukagigur,in a project developed by co-PI Peter La Femina, associate professor of geosciences. First, you can walk around a miniature three-dimensional scale model. Next, it expands to a full-size replica of the 700-foot-deep magma chamber—a little more than twice the height of the Statue of Liberty. This replica shows the true three-dimensional structure of the volcano, as measured using a Terrestrial Laser Scanner (TLS). Look and move up, down, sideways. Crawl into a side conduit. Thanks to the millimeter precision of TLS, you can explore and experience every surface and perspective, essentially as if you were there. You can even activate tools that measure diameters of the structures and volumes of the spaces you see.

Research has shown that psychologically, virtual experiences feel very real to users. For example, even though you know you are standing on a floor inside a room, when you see a virtual cliff in front of you, you won't step off the edge, and you will duck to avoid being hit by anything that appears to come flying at you.

iVR allows for learning experiences without traveling to places like Iceland or Brazil and without incurring the costs associated with such trips. Despite the University's emphasis on internationalizing education, only about two percent of students actually travel each year on study abroad. Even when cost or time are not barriers, safety concerns can be, Klippel said.

"This project will show how we can use iVR for specific lessons in three different types of courses," Klippel said. The first three courses are GEOG 498 Island Sustainability, taught by Neil Brown; GEOSC 597 GeoVision in the Earth Sciences, taught by Peter La Femina and colleagues Roman DiBiase and Ken Mankoff; and ARCH 536 Joint Architecture and Landscape Architecture Design Studio, taught by José Duarte and Tim Baird. Another course in planning is GEOSC 434 Volcanology, also taught by La Femina. The different types of courses allow for demonstrating the advantages from integrating iVR into online, hybrid, and residential learning. "We will be able to show both the use of different technologies that only recently have become available, such as 360 video cameras and LiDAR equipped drones, and different subjects from social, to urban, to physical applications."

"We are incredibly excited to support this project and about its potential for improving the learning experiences of students at Penn State," said Brad Zdenek, Innovation Strategist for COIL. "Alex and his team are actively expanding access to engaging educational experiences for all students and providing new ways of seeing and interacting with their world."

Island Sustainability is a hybrid online and in-field course focused on islands and the relationships between global drivers of change and the local implications and associated adaptations. GeoVision in the Earth Sciences is an exploratory course that addresses questions of how advanced visualizations can improve research and education in the earth sciences. The third course is a joint architecture and landscape architecture design studio offered to fifth-year and masters students. The focus of the design studio is to work remotely with a collaborating studio in Rio de Janeiro, Brazil, to study and understand the design of a favela, or slum, located there.

This past summer, Duarte visited his field site in Brazil and collected 360-degree video data and coordinated with local collaborators for additional data. The volcano data for La Femina's project is already accessible through iVR experiences, so the team is engaged in tool development and refinements. This fall and spring, the courses that are part of this proposal are being offered. For each course, there will be a course module using course specific data, curated learning modules, and the custom-made iVR app. Each module will be evaluated and experiences gained will inform improvement for sequential courses, Klippel said.

More information: You can learn more about the project at sites.psu.edu/vreducation

Provided by Pennsylvania State University