Virtual Fieldwork in Introductory Geoscience Courses: Approaches and Possibilities
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Abstract

Immersive virtual field environments (IVFEs) are increasingly used in terrestrial and planetary geologic research. Given this trend, incorporating these environments into introductory geoscience curricula is an important step to familiarizing students with how contemporary geologic research is done. As these environments become more sophisticated, realistic, and economical they provide geoscience instructors with an alternative field-like experience whenever budget, time, accessibility, location, or liability limit field opportunities. They also provide a vehicle for preparing students for work in the field. This poster is an examination of current work in technical and educational IVFE design, use, and assessment. It is also a proposal for the development of a series of IVFE that would be used with students taking introductory geology at the undergraduate, high school, and middle school levels. The proposed IVFEs would be 3D digital models of several locations characteristic of Northwest geology. Each exposure would be designed around selected problems and activities appropriate to introductory level geology. The educational research component of this project would focus on the question of whether it is possible to construct an authentic IVFE that is meaningful to introductory students.

IVFEs in geoscience research

Terrestrial outcrops

Virtual models are digital models of human scale outcrops created with ground-based LIDAR or photo-modeling software. These models enable teams of geologists to conduct collaborative analysis of field sites, review findings of their peers, and connect local geology with regional geologic structure (Clegg et al., 2005; McCaffrey et al., 2005).

Planetary geology

Digital models of planetary sites are constructed from remote sensing data produced from planetary probes. Environments of this type enable planetary geologists to view and analyze surface data from Mars Pathfinder data in much the same way that geologists would interact with a terrestrial outcrop (Head et al., 2005; Stoker et al., 2006).

IVFEs in geoscience education

Quicktime VR coastal cliff

This virtual environment is a simple 2.5D representation of a shoreline cliff in southern California. Though it is much less complex than many available virtual field sites, it is unique in that it was constructed and evaluated as part of a geoscience education thesis by a masters student in geology at San Diego State University (Brown, 2005).

Geology Explorer

GE is a role playing game designed to teach several concepts covered in general geology courses (rock and mineral identification, geologic mapping, and stratigraphic interpretation). In this game students play the role of researchers surveying the geology of an earth-like planet. GE is the product of the World Wide Web Instructional Consortium of North Dakota State University in Fargo ND (Browne et al., 2006).

GeoWall Field Site

Faculty at Northern Arizona University (Flagstaff AZ) use virtual field sites in conjunction with a presentation technology called GeoWall to prepare students for field camp (Kelly and Riggs, 2006). GeoWall is a projection system that enables teachers and students to see digital objects and photographs in 3D using pairs of plane polarized images (Kelley and Riggs, 2006). GeoWall is a role playing game designed to teach several concepts covered in general geology courses (rock and mineral identification, geologic mapping, and stratigraphic interpretation). In this game students play the role of researchers surveying the geology of an earth-like planet. GE is the product of the World Wide Web Instructional Consortium of North Dakota State University in Fargo ND (Browne et al., 2006).

Institutional design and research questions

Authenticity and data adequacy

• How realistic does the environment appear?
• What is the student doing when interacting with the IVFE, to what extent does it simulate an actual visit?
• What data needs to be imbedded in the IVFE and how should it be imbedded to give the students a somewhat authentic experience?

Augmentation

• What is augmentation?
• How do students perceive different augmentations (e.g. geologic maps, cross sections, seismic sections, etc.)?
• What is augmentation instructionally appropriate?

Adaptability

• How do students learn from interacting with an IVFE transfer when they visit actual sites?
• Does preparing with augmented IVFEs prematurely “color” students’ perceptions of what they are seeing in the field?

Opportunities for research and development

Environment and activity design

A promising approach to designing authentic IVFEs is to make conceptual and behavioral mapping of student and professional field activity part of the development cycle. This type of psychological data would provide IVFE builders with important insight into the interface and data design of these environments.

Integration with geospatial viewers

Another opportunity is to link IVFEs with geospatial viewers such as World Wind and Google Earth. This shows students where sites represented by these environments are, and could also help them to understand the connections between the local geology of the site and regional geology derived from geophysical surveys.

Web delivered IVFEs provide on-line students with an introduction to solving problems in the field, however, there is much to learn about the role of team member collaboration in field work and how this teamwork could be integrated into the generally solitary realm of the on-line learner.

References

Brown, J. D., 2006, Learning Outcomes of Virtual Field Trips Used for Geoscience Education - San Diego State University, Apt. 7.