Technology in the Geoscience Classroom

*(writ large: Classroom, Lab, and Field)*

Steve Whitmeyer *(James Madison University)*

…with input and help from Declan De Paor, Mladen Dordevic, Callan Bentley, Chris Atchison, and many others!
Technology in the Geoscience Classroom

Things to ponder:

1. Technology developers assume that their creations enhance student learning
2. Educators want evidence that the technology is improving student learning
3. Students’ have their own expectations
4. The broader reach of technology-facilitated education
Technology in the Geoscience Classroom

Levels of technology in education:

1. Passive observation – “eye candy”

2. Student-driven investigation facilitated by technology

3. Real-time “instantaneous” feedback integrated with student-driven investigation

...with examples from the classroom, lab, and field
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Built with MaRGE tool:
http://geode.net/margee/
(Dordevic & Whitmeyer, 2015)
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The classic Atlantic mountain belts correlation question…

Pangaea breakup: GEODE.net/Pangaea
Fault plane model from 2011 Virginia Earthquake aftershock data

http://csmres.jmu.edu/Geollab/Whitmeyer/web/visuals/GoogleEarth/VAquakes.mov
Inquiry-driven models

IRIS Earthquake Browser

http://www.iris.edu/ieb
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Visible Geology

http://app.visiblegeology.com/

Inquiry-based, student-driven exploration of 3D models
Inquiry-based, student-driven exploration of 3D models
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EarthQuiz
http://earthquiz.net

Exercises with real-time feedback
Technology in the Geoscience Classroom

EarthQuiz

Exercises with real-time feedback
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EarthQuiz: More than 500 sites/questions

Part I
The vertical columns on this landform are an example of which geologic process?
- Glacial scouring
- Depositional layering
- Freshly crystallized igneous rock cooling and contracting
- Compressional folding

Part II
Now guess the location of the feature by clicking on the map below or dragging the marker.
Fold Analysis Challenge

Sheep Mountain Anticline

Google Earth Plug-in or Stand-alone GE application

www.geode.net/fac
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*Students expect technology-facilitated, inquiry-based learning.*

*Instructors need to assess its effectiveness.*
Technology in the Field

Paper? or Digital?
Technology in the Field

Digital mapping & data collection in the field

Mapping geology with an iPad, iGIS, and ArcGIS
The iGIS app showing point data over high resolution orthophotos.

Simple GIS shapefile data table for outcrop data collection in iGIS.
Outcrop data collected by 14 student teams during 4 day digital mapping project at JMU Ireland Field Course in 2014
Crowdsourcing Field Data Collection

6 years of data from the digital mapping project
Crowdsourcing Field Data Collection

6 years of data from the digital mapping project
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>Moderate</td>
<td>Considerable</td>
<td>Extensive</td>
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<td>Slightly apprehensive</td>
<td>Neutral</td>
<td>At-ease and comfortable</td>
<td>Highly motivated</td>
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<td>Extensive</td>
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<tr>
<td>My <strong>feelings</strong> after this</td>
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<td>Neutral</td>
<td>At-ease and comfortable</td>
<td>Highly motivated</td>
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<tr>
<td>I found this exercise to be:</td>
<td>Not valuable at all</td>
<td>Only slightly valuable</td>
<td>Moderately valuable</td>
<td>Useful</td>
<td>Essential</td>
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<td>Competent</td>
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<td>My overall learning from this</td>
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<td>Trivial</td>
<td>Moderate</td>
<td>Considerable</td>
<td>Extensive</td>
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Assessment data for six years of digital mapping exercises; mean of responses, n=167. Significant gains were recorded in Feelings, Skill Level, and Knowledge. Assessment template from Pyle (2009).

(Whitmeyer & De Paor, 2014)
Technology-Enhanced Field Access

Smart glasses can pair wheelchair students with agile students at the outcrop

Real-time video conferencing in the field – Facilitating field access for SWD
Technology-Enhanced Field Access

GEOPATH: Inclusive Field-Based Geoscience Undergraduate Research Opportunities for All

The program will feature a cohort of six teams over two years conducting field research in Arizona and Ireland.

Learn more and apply to participate at: www.theiagd.org/geopath

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