

Project Name

Evaluating Geologic Mapping Tools for the Undergraduate Curriculum

Principal Investigator Martha Growdon

Campus Oneonta, State University College at

Year of Project 2012

Tier Tier One

Project Team

- Leslie Hasbargen, SUNY Oneonta

Overview Summary

Pilot use of the first digital field-mapping evaluation, comparing available tablet computers and Geographic Information Systems (GIS) in side-by-side field tests, to train students to produce new 1:24000-scale geologic maps of New York State (NYS) to investigate potential horizontal drilling and hydraulic fracturing.

Outcomes Summary

Compared Google Nexus and iPad for geological field use, as well as a number of Apps. [Outcomes](#) indicate common challenges and student preference depending upon tool used.

Project Abstract

This project will determine the most student-accessible, cost-effective yet reliable digital field mapping system by conducting the first digital field-mapping evaluation, comparing available tablet computers and Geographic Information Systems (GIS) in side-by-side field tests, with the broad goal of training students to produce new 1:24000-scale geologic maps of New York State (NYS). This is particularly relevant due to potential horizontal drilling and hydraulic fracturing (“hydrofracking”) for natural gas in the Marcellus and Utica Shales. We will recommend the best system to other SUNY colleges, so they may undertake regional mapping with students,

and will offer training in the use of digital mapping tools.

Geologic mapping is a basic yet essential tool for documenting local geology, and is of supreme importance in NYS prior to large-scale natural gas development. Substantial gaps in publicly available geologic information exist in the state because 1:24000-scale bedrock geologic map coverage is far from complete. These gaps prevent the public from being adequately informed about geologic activities that may have societal impacts. It is therefore imperative to find methods by which accurate, reliable geologic maps can be rapidly produced for NYS. There is no lack of geology professors and students to undertake such mapping, but paper pace-and-compass methods are too time-consuming for our immediate needs, and efficient production of geologic maps has heretofore been financially untenable for many programs. The recent advent of affordable, versatile, tablet computers and expansion of non-proprietary GIS software now makes digital field mapping widely accessible. Testing of these newly available technologies is necessary to identify the best system for students to rapidly and reliably create detailed, accurate, professional-quality geologic maps.

We will use three dedicated venues to evaluate digital mapping techniques and train students in their use: GEOL 275: Geologic Data and Analysis (fall 2012); GEOL 343: Field Geology of Plate Boundaries (spring 2013); and independent student mapping research (spring 2013). In each, groups of five students will be responsible for mapping a specified area; each student in a group will be assigned one of four GIS programs or traditional paper methods, and will produce a small geologic map to be compared to the four others produced by the group. Students will receive a list of observations to be recorded, so the data collected will be consistent. Each course will produce three sets of five maps per project, to be evaluated for accuracy, depth of information, and ease and time of production. Students will use different methods for each subsequent mapping project so that all students gain experience with digital mapping. Student responses to pre- and post-mapping questionnaires will gauge student-friendliness of the mapping systems, and assess the increase in knowledge associated with each platform and software.

We will test four different GIS packages on two tablet computing platforms with initial test groups of 15 students. Each tablet computer will be equipped with basic software necessary for fieldwork, including software for compiling field reports, software for cataloging field sketches and photos, and software for measuring orientations of rocks in the field. In addition, each will also have two GIS applications installed (iCMTGPS and GIS Pro on iPads, QGIS and Mapitfast on Toughpads), chosen to ensure the same basic functionality of each tablet computer and the ability to evaluate the functionality and usability of variously priced GIS packages on each platform. Thus, the methods to be tested are: pen and paper; iPad with iCMTGPS; iPad with GIS Pro; Toughpad with QGIS; and Toughpad with Mapitfast.

In addition to evaluating digital field mapping platforms, we will evaluate the effectiveness of these systems as teaching tools. Two camps of thought exist on teaching digital mapping: one avers that students view digital techniques as a “black box” and don’t develop the necessary quality-control skills that by-hand techniques instill; the other claims that student learning is enhanced by digital techniques and students can learn more effectively with digital tools than without. Employers and graduate schools commonly expect our graduates to have experience with GIS and digital field mapping, and students must collect the same types of data in the field regardless of mapping platform; digitizing data on site allows them to collect more and potentially better data. Too often students learn how much data they need to record in the field only when they return to the lab and start to reduce the data. Digital field mapping allows students to combine several datasets on a single screen, mark points, trace contacts, make observations, and define and reduce data, all in the field. Students can see and evaluate potential trends, and collect more data as needed. If data reduction and digitization occur on site, students save valuable time and, potentially, the cost of returning for more measurements. We hypothesize that having the power to evaluate data and find trends while doing the mapping will make the final product better and will more effectively teach mapping techniques.

Paper-based geologic mapping is increasingly archaic (Pavlis et al., *Geosphere*; 2010; v6; no3; p. 275– 294). Inexpensive tablet computers and GIS software open the door to digitizing information on the spot, eliminating tedious transcription and increasing efficiency and productivity of geologic maps, which inform the public of

potentially vital geo-societal activities. Tablet computers can replace many traditional geological tools and more expensive rugged field computers. Identification of the most student-friendly yet accurate and reliable tablet-based field mapping system will facilitate the renewal of detailed bedrock mapping at this critical geo-political juncture in NYS.

Reports and Resources

- [Powerpoint presentation](#)

Discipline Specific Pedagogy

- STEM

Instructional Design

- Mobile Learning