

**Application for 2013 Innovations in Teaching Using Technology Grant:
Instructional Technology and Faculty Center for Excellence in Teaching and Learning**

Title: Hometown Surface Water Investigation

Courses Involved: Water Resources Planning and Investigations in Physical Geography

Applicant: Dr. Charles McGlynn, Assistant Professor of Geography

Objective:

The Vernier LabQuest 2 is a second generation portable, modular system used to collect water quality data. It features built-in graphing and analysis capability and has a wide, high-resolution touch screen that makes it fast and intuitive to retrieve, analyze, and share data from experiments. It also features a free app that allows multiple users to collaborate and view data via their smartphones. Advanced analysis and video can be achieved via a computer interface using Vernier software. The Connected Science System is a networked assortment of probes and sensors that support collaborative, hands-on learning. Students can collect, view, analyze, and annotate data on an iPad or any device with a compatible web browser.

FieldScope is a new, web based GIS software. National Geographic developed FieldScope to be a user friendly, mapping, analysis and collaboration tool that will promote geographic investigations. FieldScope uses base-maps with multiple, user defined layers and parameters that offer fantastic flexibility and adaptability for citizen scientists. It allows for spatial analysis of user collected data along with data from NOAA and other official sources. It enriches scientific investigations by providing spatial context through maps, activities, and a budding community of learners. Field data can easily be combined with that of other students and professionals, which adds depth and meaning to analysis. In addition to data, FieldScope enables students and classrooms to upload their own field notes, photos and other media. Thanks to the National Geographic Society, FieldScope is also free!

Description of Specific Innovation:

Combining the LabQuest 2 with FieldScope would allow students to investigate the nature and quality of surface water bodies in their local communities during a semester. This data would be available to the wider FieldScope community and classes could compare data collected over time. For example, GIS coordinates will allow analysis of field measurements upstream and downstream of a sewage treatment plant, tributary or factory which will further facilitate curiosity and learning. Salinity (including TDS), pH, Dissolved Oxygen, Turbidity and Temperature are indicators of water quality that can be measured with the LabQuest 2. This data would be uploaded to FieldScope and used to complete exercises and lessons on water quality in streams and lakes. Estuaries and other tidal water bodies such as salt pans can also be evaluated.

Water flow paths can be traced using GPS coordinates and FieldScope software, individual tributaries and entire watersheds can be mapped using the following FieldScope layers during a “trip down your tributary”: Satellite Imagery, Street Map, Topographic Map, and Boundaries and Places. Students can list the names of the streams and rivers that connect their location to the Delaware Bay or Atlantic Ocean.

Students will investigate how water flows throughout a region and what defines water flow patterns. They will learn how physical geography impacts water flow paths. Using the polygon tool and terrain layer students will be able to identify watershed boundaries using maps and understand how the USGS delineates watersheds.

Maps of physiographic regions provide an overview of terrain variation. Geology and terrain variations delineate physiographic regions. Using the Physiographic Regions Layer in FieldScope students will look at water flow paths and consider how it follows boundaries of the physiographic regions. Students can then compare physiographic regions. Students will also investigate how people have shaped the landscape in their watershed. They will work with map layers in FieldScope to examine patterns of land development patterns and trends over time, in order to investigate why people settled where they did. The lesson can then be extended by analyzing the relationships between development patterns and variations in water quality.

Scalability and Adaptability:

The lessons learned from the Hometown Surface Water Investigation will be available to the wider community of citizen scientists and professionals via the FieldScope interface. This knowledge base will develop over time with data collected by Rowan students. Students not from New Jersey or unable to visit home during the semester will still participate by adopting a local hometown to study.

The ability to extend the power of the LabQuest 2’s graphing software via smartphone will make group outings a more inclusive and rewarding experience. This equipment is state of the art, rugged and adapted to today’s emerging technology. These field experiences will also provide practical training and real-world environmental studies experience for students. I fully expect this initiative to become an ongoing project that will not only collect data on New Jersey’s watersheds, but also adapt to the technologies of the future. FieldScope is already adding new features and capabilities. With the release of the LabQuest 2, Vernier has responded admirably to its customer base’s issues and suggestions with the original LabQuest.

Instructional Technology Support:

As described above, FieldScope is a free resource, we are requesting the Vernier LabQuest 2 and the necessary sensors and probes in order to more fully realize FieldScope’s potential in a

university setting. FieldScope is maintained by National Geographic (including data hosting), no additional hardware or support from Rowan's technology office would be necessary.

Plans for Evaluating and Sustaining Innovation:

The project will be assessed using several tools during and at the end of the semester:

1. Instructor feedback and evaluation of the LabQuest 2 and FieldScope technology
2. Instructors will offer support and feedback to students regarding data collection and analysis
3. Weekly discussions to recap efforts, identify trends and water quality issues
2. Student feedback and evaluation of the LabQuest 2 and FieldScope technology
3. Consultation with National Geographic's FieldScope team on any software issues
4. Consultation with Vernier Corp. regarding any potential hardware problems

Budget:

The Geography and Environment Department will use funding from the grant to purchase equipment from Vernier Corp. This equipment will be kept in the Geography and Environment Department and available for instructors and student check out.

Item	Quantity	Price
Vernier LabQuest 2	1	\$329
LabQuest 4GB SD Card	1	\$12
LabQuest 2 Stand	1	\$5
LabQuest 2 Lab Armor	1	\$15
Salinity Sensor	1	\$92
Tris Comp pH sensor	1	\$99
Dissolved oxygen probe	1	\$209
Turbidity Sensor	1	\$112
Temperature Sensor	1	\$29
Vernier mobile app	n/a	Free
FieldScope (web based)	n/a	Free
Total		\$902 (before shipping)

LabQuest 2 Key Features:

- Rechargeable, high-capacity battery
- Compatibility with Windows and Apple platforms
- Free software updates
- Collect, analyze, and share sensor data wirelessly on any device with a web browser
- Large high resolution screen with portrait and landscape orientations
- High powered processor for fast analysis and graphing
- Built-in sensors including GPS and accelerometer
- Fast data collection with 100,000 samples per second
- Real-time graphing and live sensor data display
- Powerful analysis with linear and curve fits
- Built-in periodic table, stopwatch and scientific calculator
- Touch and stylus navigation for efficiency and precision

LabQuest 2 Reviews:

“In summary, the LabQuest 2 from Vernier is an outstanding tool to engage students in scientific inquiry. In my opinion, its reasonable price and ease of use make the LabQuest 2 a valuable tool for students conducting scientific investigations. It can help motivate them toward greater science achievement. If you’re interested in a versatile and cost-effective tool that is user friendly, look no further than Vernier’s LabQuest 2.” Source: NSTA Recommends

“I used the system for several weeks to do everything from analyzing the motion on a swing and watching the voltage of a battery decline to monitoring the light of a sunset and taking longitude and latitude locations fixers in conjunction with sound and light readings. Its ability to grab data and analyze it is without comparison in such a small unit.” Source: Scholastic Tech Tools

“Vernier’s LabQuest 2 can build interest in science, make experiments come alive, and deepen understanding of complex concepts. The affordable handheld tool supports student-centered, inquiry-based learning, high-end data collection, and critical analysis as budding scientists use real tools to conduct real-time investigations of natural phenomena.” Source: Tech & Learning

“It seemed obvious that the LabQuest 2 would be a real game changer in the data collection space, but after our field test, it seems more that the LabQuest 2 has invented an entirely new game. However, ultimately it falls on the teachers and students to truly imagine the potential of this technology. In fact, I’d even go so far as to say that human imagination is the main limit of Vernier’s Connected Science System right now.” Source: NSTA Blog, Science 2.0