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TEACHING NOTE

Bridging the Gap between the Classroom and Business: A View from Geology

Michael A. Penzo, PG, CPG, LSP

When we hire entry-level geologists fresh out of school ... we have to pay them for a week of training, plus the cost of training... We're certainly not averse to hiring entry-level geologists. We can and do hire them when the need arises. But I could see looking for someone with one or two years of experience over an entry-level candidate ... They know what work is, and understand the field a bit better.

These words were uttered by one of my former colleagues in the environmental consulting industry. They address a question often asked by students in my Geology courses at Bridgewater State: “Why is no one hiring entry-level geologists?” In truth, entry-level geologists with experience and training *are* being hired. But how does anyone get that experience and training while going to school and working part-time or, in some cases, full-time? In Geology, there is a disconnect between what colleges offer their students and what businesses in the field need. It is a problem that I am attempting to address in my courses at BSU.

The challenge is to provide students with a rigorous learning experience by modeling the methods and expectations that they will face in the environmental consulting profession after graduation. Two models have existed for some time: the Cooperative Education (or Co-op) model, which alternates academic quarters with work; and the Summer Internship Model, which many universities offer in some form. But at BSU, neither model works. We have no Co-Op program and too few of our students have time for a summer internship. But there is a third option: create a classroom that mimics the environmental consulting business workplace while insisting on

rigorous academic content. Drawing upon my 35 years of experience as an environmental consultant, I have begun to frame courses in Geology that bridge the divide between the worlds of university learning and professional practice.

Hydrology 240 Inc.

In the fall of 2015, I had the opportunity to teach “GEOL 240 Hydrology,” an upper-level undergraduate course required for Geology majors. The course is modeled after a functioning environmental consulting firm. Specifically, it aims to impart four main skills necessary to succeed in obtaining an entry-level environmental

consulting position with a Bachelor’s degree in Geology: academic mastery, technical application, business competence, and accountability. Academics includes understanding surface and groundwater flow, groundwater quality, the hydrologic cycle, Darcy’s Law, the Theis and Theim equations, flow nets, and performing routine hydrogeological calculations. Technical applications include preparing groundwater contour maps and flow nets, running groundwater flow simulations, monitoring wells and sampling groundwater, and understanding soil vapor extraction systems and other remedial technologies. Business skills include communicating findings comprehensibly to an audience in clear and concise writing, working cooperatively, meeting deadlines, accepting constructive criticism, and networking with other environmental professionals. The final skill is accountability, a very difficult concept to teach. However, it can be modeled. The course sets high expectations and standards; no excuses are accepted for late work except illness or work, and students and their instructor are responsible to each other.

In this course, it is critical for students to perform the same types of writing, calculations, field activities and



U.S. Geological Survey’s Toxic Research Site on Cape Cod (Source: U.S. Department of the Interior | U.S. Geological Survey, <http://ma.water.usgs.gov/MMRCape/toxics.html>)

professional activities that they will as environmental consultants. This includes how to act, dress and speak in a professional environment. Course assignments aim to develop students' capabilities in hydrogeologic calculations; technical writing; crafting maps, cross-sections and tables; researching

conductivity, created groundwater contour maps and performed seepage measurements from groundwater to surface water. The second field trip went to the Gulf Cumberland Farms (GCF) Middleborough MCP Disposal Site, where Matthew Young, Senior Environmental Project Manager

cleaned up using a soil vapor extraction system, then in the process of being installed. With the permission of Gulf Cumberland Farms, this site was used for our second group project.

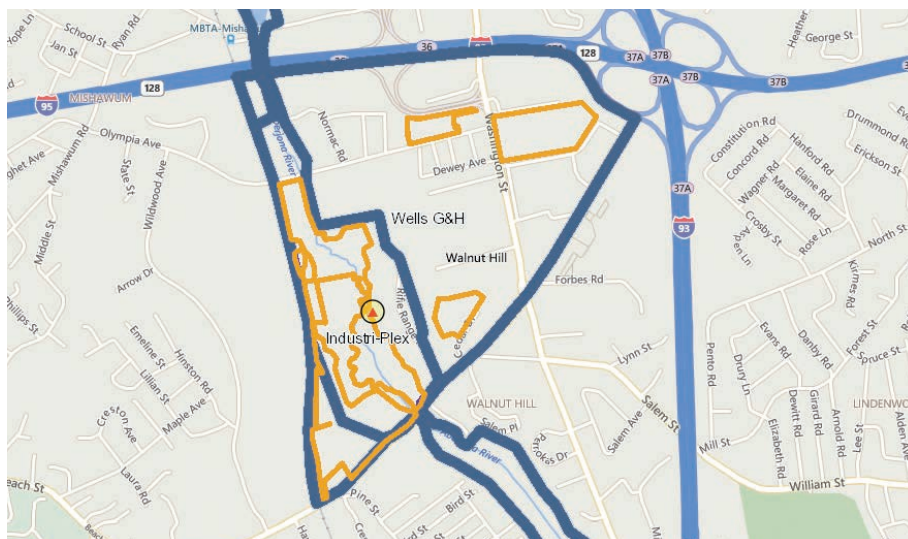
In addition to field trips, students in Geology 240 attended two professional conferences, gatherings that are critical to any environmental professional's career advancement. The first was the AEHS Conference on Soils, Sediments, Water and Energy at UMass Amherst in October 2015. There, six BSU students attended seminars run by environmental professionals and networked with senior environmental professionals from a variety of consulting firms. Our students brought their resumés with them, and one of them was impressive enough to get a job interview. The second gathering they attended was the Licensed Site Professional Association (LSPA) membership meeting in November 2015. The LSPA is a professional association that advocates for the cleanup and reuse of Massachusetts properties that have been contaminated with hazardous waste—"brownfields." At this meeting, our students had the opportunity to network with senior environmental professionals and attend a technical presentation on Massachusetts Environmental Regulations.

In this course, it is critical for students to perform the same types of writing, calculations, field activities and professional activities that they will as environmental consultants. This includes how to act, dress and speak in a professional environment.

and reviewing Federal and State regulations, laws and databases; monitoring and sampling to collect field data; and making technical presentations and client presentations—both individually and in groups.

Field trips are central to the course. In fall 2015, we did two. The first one went to the U.S. Geological Survey's (USGS) Toxic Research Site on Cape Cod. Denis LeBlanc, Senior Hydrologist at USGS, ran the visit, which gathered student groups from Bridgewater State, Massachusetts Institute of Technology and the University of Massachusetts Amherst. Students gauged monitoring wells, collected and field-analyzed groundwater samples, calculated hydraulic

with GCF (and a BSU alumnus), provided an overview. A former gas station/convenience store, this site had soil and groundwater contamination and is now being assessed and



The Wells G & H Superfund site in Woburn, Massachusetts (Source: United States Environmental Protection Agency)



Students in Geology 240 doing a groundwater seepage study of a pond on Cape Cod. Denis LeBlanc of the US Geological Survey is instructing the students (Author's photo).

Group projects and client projects continued the exposure of these students to the sorts of hands-on work that hydrologic professionals do. Most projects at environmental consulting firms are group efforts. In fall 2015, the two projects we undertook provided students with a chance to learn about the federal Superfund regulations and the Massachusetts environmental regulations related to waste site cleanups. The first of these concerned the Wells G & H Superfund site in Woburn, Massachusetts made famous by Jonathan Harr's 1996 book and

the 1998 film, *A Civil Action* (both of which we discussed in class). In two groups consisting of project managers, project geologists, technical writers and graphic artists, students represented expert-witness consulting firms for two potentially responsible parties. Using the Wells G & H data set to calculate groundwater flow, contaminant transport and the sources and extent of contamination, each group then prepared a technical report and an argument specifying for how much of the contamination in Wells G & H their

respective clients were responsible. The exercise concluded with a presentation from Dr John Guswa about his experiences as a *real* expert witness on Wells G & H site case.

For our second group project, involving the Middleborough GCF site, students reviewed the work that had already been performed at the cleanup site and, using data gathered from the Massachusetts Department of Environmental Protection (MassDEP) on-line database, put together a Phase I Initial Site Assessment Report and

Phase II Scope of Work plan. The students prepared groundwater contour maps, isochem maps, proposed additional subsurface investigation maps, and a Method 3 Risk Characterization. The project was completed in formal client presentations—in oral and written forms—to GCF Project Manager Matthew Young, almost

and it requires hard work, clarity of thought and perseverance. Especially perseverance. But how to teach that quality is a challenge that faces us all. Self-confidence is key for our students to make a successful transition to the world of professional work. Many of our students arrive at BSU with a

In addition, the students developed and exemplified self-confidence *as a group*. After our joint field trip to the USGS Toxic Substances Research Center on Cape Cod with students from MIT and UMass, I received an email message from my contact at the USGS telling me how impressed the professor from MIT was with BSU students and their ability to learn and perform the skills taught during the field trip. And when I showed my students this email, they were visibly moved by it and seemed even more self-confident afterward.

Of the seven students in that fall 2015 course, two were immediately hired by environmental consulting firms and are currently working in the field. One received a scholarship from the LSP Association and was a summer intern at the Museum of Natural History in New York. One went on to graduate school. So, overall, the course was successful in achieving its goal of preparing students for entry-level geologist positions with environmental consulting firms. And in making them “job-ready,” GEOL 240 helped explode the sometimes intimidating psychological barriers that separate classroom study from the “real world” of work.

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exactly as a consultant would perform a project under the Massachusetts Contingency Plan.

Learning Work Culture: There’s No Crying in Baseball

There is an often-quoted line from the 1992 film *A League of Their Own* that says “There’s no crying in baseball.” The same goes for the business world. To be successful, there’s no room for whining or excuses. There’s no hiding mistakes. We have to learn to take responsibility for our actions and errors; to recognize, admit and correct things when something goes wrong. The working world is much more competitive than the academic environment,

self-confidence deficit and it is imperative that we tackle it head on. It can be a direct impediment to getting a good position after graduation.

One of my Hydrology students had low self-esteem and self-confidence and felt that she could not do well in this course. To this I responded that it was my goal to help her realize that, by doing the real work that professional hydrogeologists do, she is capable of succeeding and having confidence in her own abilities. That student turned out to be one of my best and earned an A in the course. When one of my colleagues in the field asked me to recommend a student for a position with his company, I recommended her. She is working at his consulting firm and my colleague thanks me every time I see him.



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