In many schools, engineering is the new "shop" class. Can engineering come out of the ghetto and into classrooms?

How are engineering thinking skills integrated into your lessons?

How might understanding the Engineering Design process strengthen your skills as a STEM educator?

Do you think this effort is realistic?

What do students understand to be the relationship between Science and Engineering?

Electrokinetic Remediation: Electrolysis of Iron Anodes for Treatment of Contaminants

RET Participants: Susan Agger (Maynard Ecology Center, Cambridge Public Schools) and Jessica Quinn (Peaves High School)

Faculty Mentor: Dr. Akram Alshawabkeh (Department of Civil and Environmental Engineering)

Figure 1. Basic Electrolysis Set-up.

Figure 2. Experimental Set-up at Separated Chambers and Power Source and b) Clean-up View of Separated Chambers.

Figure 3. Experimental Iron Electrodes, used in Open Chambers.

Figure 4. Taking Measurements: a) Susan recording pH b) Jessica recording pH.

Impact

To raise awareness the RET program nationwide, to build collaboration across funded programs, and to share lessons developed for classroom implementation. Northeastern University participants have assisted in the coordination and presented at the NSTA National Science Teachers Association National Meeting since 2004. [http://www.everyculture.com/images/ctc_02_img0465.jpg]

This informal session provided an opportunity for networking among former RET participants and program administrators representative of a variety of programs and geographic locations. It provided an opportunity for sharing classroom connections, successes, and obstacles "back in the classroom," and to discuss useful professional development and other programmatic strong points.

Agenda

Welcoming Remarks
Claire Duggan - Northeastern University
Brent Miller - South Dakota School of Mines and Technology (SSSM&T)
Jay Dubler - Columbia University

Participants Introductions

Lesson Development
Participants share lessons developed.

Discussion
Matthew Corcoran (moderator) RET, Northeastern University

Professional development should engage science educators in transformative learning experiences that confront deeply held beliefs, knowledge, and habits of practice. Professional development programs must maintain a sustained focus over time, providing opportunities for continuous involvement. The success of Northeastern University's Research Experience for Teachers program lies in the collaboration between participants and the university research community. RET teachers see the opportunity to positively impact the lives and education of their students while deepening their own content knowledge. RET across the country is bridging the gap between K-12 educational requirements and cutting-edge research by creating innovative classrooms that surpass the traditional.

RET provides a sustained focus of activity for teachers (high activity), how can we provide support for ever-evolving needs of teachers?

RET-PLUS (Partners Linking Urban Schools)

Build and support a K-16 STEM community: a dynamic partnership between RET participants, undergraduate and graduate STEM students, higher education faculty and private industry.

How do I bring my RET experience into my classroom?

Teachers in RET programs across the country are challenged to bring their research experiences into their classrooms.

One 2007 team spent their summer focused on the Clean-up of contaminated soils by electrokinetic techniques. Under the direction of Professor Akram Alshawabkeh, the Gordon Center for Subsurface Sensing and Imaging they studied electrokinetic electrolysis in batch experiments.

Lesson for High School students

"Bioremediation at Quesada Ranch, Coffee Plantation, Quesada Community, Guatemala"

The work of Dr. Alshawabkeh’s laboratory focuses on the electrokinetic remediation of groundwater systems. While the concept of soil contamination is quite understandable, its ramifications are not as clear. We chose to focus on bioremediation (nitrates specifically) and its connections to energy in the ecosystem rather than redox reactions which are covered in Chemistry.

• How does the idea of trophic levels relate to bioremediation?
• Why is nitrate such a problem in soil?
• Can all contaminants be “clean-up” the same way (i.e. using bioremediation)?
• Do laboratory conditions differ from environmental conditions?
• Should ranchers use bioremediation or pump-and-treat techniques to clean up the soil?

Chemical aspects of soil remediation are also addressed. Students are presented with soil and water samples from the ranch and asked to analyze nitrate contamination. In addition, students are asked to assay pH, DO, and how their experiment in the lab may differ from conditions in the field.

... and for Middle School students

Bioremediation has curriculum connections to middle school earth science, chemistry, technology and engineering.

• Examine composition and physical characteristics of soils and their properties i.e. porosity, soil moisture and compactness
• Use wet chemistry test kits, electronic probes and test strips to test for: soil moisture, pH, nitrates, phosphorous and potassium
• Bioengineering as a means to address local environmental issues such as water quality, biodiversity and soil contamination
• Investigate land forms and the processes of erosion, deposition, the flow of water and groundwater using models and stream tables
• Learn about the water cycle and the impact surface water and ground water have on watersheds
• Learn how scientists and engineers utilize USGS, topographical and contour