Bringing Data & Research into the Classroom

Josh Galster
Earth & Environmental Studies Dept.
Montclair State University

Laura Rademacher
Geology and Environmental Science Dept.
University of the Pacific
Our backgrounds

• **Josh**: Taught at Montclair State (public university in NJ) for 8 years
  – Interdisciplinary department that has undergrad through PhD students
  – Variety of courses from Intro courses for non-majors up through graduate course
  – Specializes in hydrology and watersheds
  – Attempts to use data in about 1/3 of all class meetings

• **Laura**: Taught at Pacific for 10 years
  – Primarily undergraduate institution
  – Intro/GE, major/upper division, and freshmen seminar courses
  – Specializes in critical zone hydrology and low temp geochemistry
  – Most courses include research projects, many classes include data

• **Your** level of experience with data/research?
Why incorporate data/research into the classroom?

• Think of and then pair up and generate a quick list of the benefits
Why incorporate data/research into the classroom? (example responses)

• Cognitive growth
  – gains in knowledge and skills
  – more able to think and work like a scientist (if made explicit)
  – communicate effectively
  – think analytically and critically
  – increased retention in the course and/or discipline

• Personal growth
  – gain confidence
  – more independent
  – more self-motivated

• Professional growth
  – interests in a science career are validated or enhanced
  – develop ties to the scientific community
Objectives for this session

• Make the case for using data and conducting research in the classroom.
• Give examples at a variety of scales.
• Have you generate exercises that incorporate data/research into your teaching.
Scale of Classroom activities

• Data & Research
  – Using data as a piece of the research process
• Time involved: 10 minutes, a class/lab, a semester?
• Individual vs. group
• Outcome: thinking (TPS), writing, presentation, homework...
Data example: Trends in Precipitation

Northern NJ Annual Precipitation (1895-2013)

- 1895-1970 mean: 44.57"
- 1971-2000 mean: 49.79"
- 2001-2013 mean: 51.80"
Data example: Images

http://earthobservatory.nasa.gov/IOTD/view.php?id=86041
Distribution of proved reserves in 1994, 2004 and 2014

BP Statistical Review of World Energy 2015
Research example

- Long-term study of AMD impacts (ES & Geochem)
Research example

- Mapping Hurricane Sandy storm surge in GIS
Tips and Recommendations for Data

• Set the tone early: begin on the first day of class
• Start with the basics: define axes, look at units, trends, etc.
• Be sure students are prepared to do what you’re asking them to do
• Ensure students see the relationship between the topic and course content.
• Incorporate group work.
• Make it clear how the use of data fits into the process of science.
• Use local examples.
Tips and Recommendations for Research

• Give detailed and clear directions at the beginning of the research experience.
• Frequent deadlines are necessary and important.
• Make clear the purpose of each component within the project and within the course.
• Build in time for flexibility.
• Give students freedom to choose a topic, with guidance.
• Ensure students see the relationship between the topic and course content.
• Peer review is helpful to provide formative feedback.
• Students should communicate results beyond the professor.
• Incorporate group work.
• Prepare students by using data in the classroom.
Individual reflection

• Think of examples datasets to present in class
• Think of possible research projects to incorporate in a classroom
  – What level of class?
  – How long for discussion?
  – What will the students actually do? Will they write, do homework, share something

Develop something that will work best for you!
Additional Resources

• On the Cutting Edge Undergraduate Research as Teaching Practice
  (http://serc.carleton.edu/NAGTWorkshops/undergraduate_research/index.html)

• Council for Undergraduate Research (CUR); On the Cutting Edge Teaching with Data, Simulations, and Models
  (http://serc.carleton.edu/NAGTWorkshops/data_models/index.html)