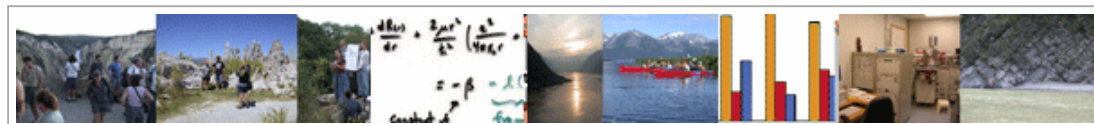




Quantitative Skills > Whats Going On > Workshop Overview

## Infusing Quantitative Literacy into Introductory Geoscience Courses

**June 26-28, 2006**  
**Carleton College, Northfield, MN**



Geoscientists recognize the importance of quantitative thinking in our field. Introductory courses can demonstrate the quantitative aspects of geoscience while increasing the quantitative literacy of a large population of students, many of whom will take no further science courses.

In June 2006, 29 faculty members from high schools, 2-year, and 4-year institutions participated in this workshop to discuss the importance and implementation of courses and activities that include QL in introductory geoscience. Workshop participants explored challenges and best practices for increasing students' QL. Participants identified several obstacles to including QL (e.g., student attitudes, faculty preparation, lack of institutional and textbook support, and insufficient problem-solving skill instruction) and worked to identify measures that might be useful in overcoming those obstacles. Because the inclusion of QL must incorporate essential instruction, work time and support for students, participants worried that some loss of geologic content may be necessary. As a result, participants identified multiple broad geologic topics and best practice strategies for incorporating QL into their courses without significant loss of content. The outcomes of this workshop include ideas for overcoming perceived obstacles, examples of best practices (in and outside of geoscience), and participants' quantitatively-rich student activities and model syllabi for courses suffused with student practice of quantitative skills.

### Best Practices

Several educators from the geosciences, mathematics and physics discussed ways that they have been working to increase students' quantitative literacy.

- Len Vacher, University of South Florida and the [National Numeracy Network](#), discussed best practices in QL and his NSF-funded initiative [Spreadsheets across the Curriculum](#) in a talk entitled [Role for Geoscience Education in Promoting Quantitative Literacy](#) (PowerPoint 27.4MB Jun26 06).
- James Myers, University of Wyoming ([Presentation](#) (PowerPoint 593kB Jun26 06)); Ken Heller, University of Minnesota ([Presentation](#) (PowerPoint 586kB Jun26 06)); and Steve Galovich, Lake Forest College, spoke about assessing students' quantitative skills.
- Steve Galovich, Lake Forest College, and Sam Patterson, Carleton College, spoke about activities that work drawing on experiences of both mathematics and geology departments. They focused on
  - [characteristics of well-designed quantitative activities](#) and
  - [Schoenfeld's Competencies in Problem Solving Domains](#).
- Several workshop participants [showcased](#) their work with quantitative skills.
- Ken Heller, University of Minnesota, presented work from the physics education community - [Teaching Problem Solving in Large Introductory Classes: The View from Physics](#) (PowerPoint 3.8MB Jun27 06)
- Eric Baer, Highline Community College ([Presentation](#) (PowerPoint 17kB Jun27 06)); Rachel Teasdale, California State University - Chico ([Presentation](#) (PowerPoint 1.4MB Jun27 06)); and Alan Whittington, University of Missouri discussed the challenges of student preparation and math anxiety.

There were many other presentations and discussions that can be found on the [Workshop Program](#)

### Perceived obstacles

Participants recognized that quantitative literacy (QL) involves students engaging in a "habit of mind" that uses data in everyday context (Steen, 2004) and geoscience courses can provide excellent context for timely problems that are data-rich. However, few introductory geoscience courses are rich in QL. Several groups at the workshop identified a number of difficulties and obstacles to increasing the QL of their courses:

- Student attitudes: not "cool" to be smart, anxiety about math /being wrong, lack of motivation/persistence, want "right" answer
- Student Preparation: wide variety of skills, lack of experience/ patience/critical thinking/common sense
- Difficulty integrating QL and geoscience: terminology/ vocabulary barriers, application is difficult.
- Faculty concerns: time constraints, design is challenging, textbooks lack quantitative content, lack of preparation/confidence
- Faculty resistance: time constraints, content vs. QL, assessment
- Lack of institutional/departmental support: no vertical integration in quantitative skills, lack of commitment by department/administrators to QL, classroom/curriculum design
- Public perception that Earth Sciences are descriptive
- Negative (?) impact on enrollments and evaluations

### Courses infused with QL

At the workshop, faculty worked to infuse courses with quantitative literacy exercises. Their many models often addressed the obstacles of student attitudes/preparation. Examples include:

- Building students' quantitative skills by scaffolding quantitative exercises throughout an [introductory geology lab](#). (Rachel Teasdale, California State University - Chico)
- An [Earth Systems Science course](#) built around a grid of essential topics and associated quantitative skills. Each syllabus topic has an associated exercise that uses quantitative skills and incorporates essential tools such as STELLA and spreadsheet programs. (Aida Awad, Maine East High School; Peter Selkin, San Diego City College; Charles Dodd, Shoreline Community College)
- A [physical geology course](#) with emphasis on developing scientific and quantitative skills through experimentation, quantification, and problem solving (Mona Sirbescu, Central Michigan University).
- A [Global Environmental Obstacles course](#) based in critical and quantitative thinking about geological problems (Walter Borowski, Eastern Kentucky University).

[Browse all of the model courses and syllabi.](#)

### Ready-to-use activities infused with quantitative skills

Workshop participants also produced a number of ready-to-use, downloadable activities, laboratory assignments and tutorials. Each is designed to help faculty to integrate quantitative literacy into introductory courses. A few examples include:

- [reading topographic maps and calculating scale](#) by Les Kanat, Johnson State College.
- using Google Earth and Excel spreadsheets to calculate sinuosity and gradient of rivers. Then, students use that information to predict the relationship. ([Stream Characteristics](#) by Wendy Van Norden, Harvard-Westlake School.)
- investigation of trends of lives and dollars lost due to major floods, graphing and analysis of results by comparing the two trends to explore flood prevention, prediction and mitigation efforts discussed in lectures. ([Floods over time: death vs. destruction](#) by Anna Tary, Bentley College)

[Browse all submitted activities](#)

### Workshop Leaders

- Cathy Manduca, Carleton College, Northfield, Minnesota
- Eric Baer, Highline Community College, Seattle, Washington
- Jen Wenner, University of Wisconsin - Oshkosh, Oshkosh, WI

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