What are some of the most effective tools?

How can geoscience societies most effectively use current or future tools?

How can geoscience societies help their individual members use these tools?

How can societies and/or geoscientists collaborate on using current or new tools?

Susan Buhr
NAGT Vice President
AGI Leadership Forum
September 10, 2012
Raising the quality of and emphasis on teaching the geosciences at all levels and in all venues

- Established 1937
- 1200 members
- Across all contexts
What is the purpose of media tools?

- Resources
- Professional Development
- Teacher Prep
- Sustainability
- Voice

Professional Community
Building NAGT Community

- Online and Face to Face workshops
- Online teaching and learning resources
- Online/print research journal
- Print magazine
- Voice for education
- Communication avenues
### Online needs of educators

<table>
<thead>
<tr>
<th>Type of institution</th>
<th>College and University</th>
<th>Pre-college</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training emphasis</td>
<td>Science content</td>
<td>Teaching skills</td>
</tr>
<tr>
<td>Needs</td>
<td>Teaching skills</td>
<td>More science content</td>
</tr>
<tr>
<td>Searching for</td>
<td>• Images • Visualizations • Labs</td>
<td>• Credible activities • Appropriate resources • Accessible data</td>
</tr>
</tbody>
</table>
Managing Your Career
- Preparing for an Academic Career
- Early Career Faculty

Enhancing Your Teaching
- Affective Domain
- Assessment of Learning
- Course Design
- Data, Simulations and Models
- Introductory Courses
- Metacognition
- Teaching in the Field
- Teaching Methods
- Urban Students and Urban Issues
- Visualizations
- Web Design

Geoscience Topics and Themes
- Biocomplexity
- Climate Change
- Deep Earth
- Discoveries from Mars

Search the Site
Classroom activities, syllabi, images, animations and more.

Workshop Schedule

For STEM Educators
A guide to those On the Cutting Edge resources that apply beyond the geosciences

Leadership Program
Featuring follow-on workshops and web resource development projects

News
- **New Visualization Collection on the 2010 Haiti Earthquake**
  On the Cutting Edge has a new collection of visualization materials related to the January earthquake in Haiti.
- **River Geomorphology Videos**
  Check out the new collection of river geomorphology videos. These videos were created by Little River Research and Design for the purpose of illustrating geomorphic principles to students in the classroom.
- **New Web Resources: Making a Case for Your Department**
  The Making a Case for Your Department web pages are a response to the pressure that departments are facing as a result of shrinking budgets, and include case studies of geoscience departments at the University of Florida and at the University of Illinois, Urbana-Champaign. Each of these departments has responded successfully to institutional pressures.
- **Module on Teaching with Jigsaws**
What is the Affective Domain anyway?

Background

The affective domain is an area in education that deals with feelings, attitudes, and values. It was first developed by psychologist David Ausubel in 1956 and further refined by other researchers. The affective domain is one of the three domains of education, along with the cognitive and psychomotor domains.

Teaching Controversial Topics

Some subjects are inherently controversial and involve more of the affective domain. For example, a discussion of Bowen's Reaction Treaty elicits a strong emotional response from most people. However, teachers are not prepared to teach controversial topics. In the education curriculum, the affective domain is often overlooked.

Defining Affective Domain

The psychomotor domain deals with physical movement, while the cognitive domain deals with knowledge. However, the affective domain focuses on the cognitive tasks of analysis, synthesis, and evaluation.

Affective change

Pre-held beliefs

The student may hold beliefs about the classroom which may affect how the student learns. Personal beliefs may be influenced by social experiences and other influences. These beliefs can make students more open to these experiences.

Biases and stereotypes

Unfortunately, the affective domain is also a place where biases and stereotypes may lead to controversial topics being avoided.

Self-Efficacy: Helping Students Believe in Themselves

This summary was written and compiled by Karin Kirsh, SERC, and contains a summary of motivation research and pertinent references.

Motivating Students

This page was written and compiled by Karin Kirsh, SERC, and contains a summary of motivation research and pertinent references.

My students aren’t motivated - how can I help them?

Teachers have a lot to do with their students’ motivational level. A student may arrive in class with a certain degree of motivation. But the teacher’s behavior and teaching style, the structure of the course, the nature of the assignments and informal interactions with students all have a large effect on student motivation. We may have heard the utterance, “my students are so unmotivated!” and the good news is that there’s a lot that we can do to change that.

“Research has shown that good everyday teaching practices can do more to counter student apathy than special efforts to attack the reasons behind it.”

Learning info

Benjamin Bloom: Educational Goals

Educational Technology

Krathwistle
Impacts

Teaching Strategies Used Weekly or Nearly Every Class Introductory Courses

- Posing questions answered by entire class: 42% (No Cutting Edge exposure), 53% (Website only), 65% (Website and Workshop)
- Small group discussion or think-pair-share: 17% (No Cutting Edge exposure), 28% (Website only), 44% (Website and Workshop)
- In-class exercises: 19% (No Cutting Edge exposure), 34% (Website only), 50% (Website and Workshop)
• Introducing Teachers to Geospatial Technology while Helping Them to Discover Vegetation Patterns in Owens Valley, California
  Kathleen Sherman-Morris, Mississippi State University, John Morris, California State University, Keith Thompson, Mississippi State University

• Teaching Radioisotope Dating Using the Geology of the Hawaiian Islands  Timothy J. Moran, Schurz High School

• Fourth and Fifth Grade Students Learn About Renewable and Nonrenewable Energy Through Inquiry  Sarah K. Fortner, Ohio State University

• A Novel Approach to Teaching and Understanding Transformations of Matter in Dynamic Earth Systems  Timothy J. Moran, Schurz High School
In the Trenches - July 2012
Volume 2, Number 3

In This Issue

- Learning About Karst: Connecting with Students in their Backyards - William K. Jones, Karst Waters Institute, Warm Springs, Virginia
- Island Karst: Constraints in Time and Space - John and Joan Mylroie, Mississippi State University, Mississippi State, Mississippi
- Building Esprit de Corps by Building Tools - Ryan A. Hillier and Marjorie A. Chan, University of Utah, Salt Lake City, Utah
- Supporting the Teaching of Teachers: A Call for Assistance - Jennifer L. B. Anderson, Winona State University, Winona, Minnesota, and Kyle Gay, University of Northern Iowa, Cedar Falls, Iowa

Online Supplements

- Web Features
- News and Advertisements

This site provides web links that supplement the print articles as well as news and web resources. To receive the full edition of In the Trenches join NAGT
CLEAN collection: Peer-review

http://cleanet.org/
Teaching Introductory Geoscience Courses in the 21st Century

Resources for Teaching Introductory Courses

- An extensive collection of introductory-level geoscience courses, spanning a host of geoscience topics
- Browse over 400 classroom and lab activities aimed at intro-level audiences
- The Starting Point - Teaching Entry-Level Geoscience, which contains over 30 modules built around pedagogic approaches for introductory courses, plus hundreds of example activities
- A special section aimed at preparing K-12 teachers for teaching earth science courses
- Strategies for working with large classes
- Tips on motivating your introductory students
- Outcomes, presentations and posters from the 2008 workshop
- A bookshelf of popular books used by faculty in their intro courses
- How to address misconceptions often held by intro-level students

Bring Google Earth into your Geoscience Classroom

SERC launched two online resources that may be useful for introductory courses.

serc.carleton.edu/NAGTWorkshops/intro
InTeGrate

Interdisciplinary Teaching of Geoscience
for a Sustainable Future

Materials Development

- Introductory modules on literacy themes
- Interdisciplinary courses
- Geoscience for engineers and scientists
- Teacher preparation modules
- Geoscience in other disciplines

Interdisciplinary Courses Under Development

- Energy, Earth, and Us
- Geologic Hazards and Humans
- Coastlines and Coastal Hazards
- Water and Society
- Modeling the Earth System

Contact Cathy Manduca
A Voice for Geoscience Education

- Strong departments
- Next Generation Science Standards
- Controversial topics
- Position papers
Making a Case for Your Department

These webpages were written by Carol Ormand.

When budgets are tight, college and university administrators may wonder whether geoscience departments are really essential -- particularly because geoscience is often a "second culture" discipline (Rossbacher and Rhodes, 2004). As geoscientists, we may feel that it is not our job to explain why the geosciences are essential. Yet, if we don't do so, who will?

The Value of Geoscience Education
Geoscience educators play a key role in educating the public about key environmental challenges facing our planet -- locally and globally -- and in preparing the next generation of geoscientists to address those challenges. Help spread the word about these key functions.

Becoming a Valued Member of Your Institution
To insure your department's value to your institution, align yourself with your institution's mission and values, be a team player, and be a source of positive public relations. The more valuable you are to more constituencies within your institution and community, the more indispensable you will be.

Strategies for Making Your Case
When you do find yourself in the position of needing to advocate on behalf of your department, here are some successful strategies and resources to help you make your case. This will be easier if you've been collecting supporting data as a matter of habit; take a look and see whether you already are.

Case Studies
As the Greek philosopher Heraclitus wrote, "Nothing endures but change." Each of the departments profiled here has made significant changes over time. Some were responding to a direct threat of elimination; others saw an opportunity and grabbed it. In every case, the departments found ways to increase their perceived value to their host institutions.

AGI Webinar
On December 4, 2009, the American Geological Institute hosted a webinar on Strategies for Departmental Survival and Viability During Economic Downturns. Geoffrey Feiss (Retired Provost, College of William and Mary),

http://serc.carleton.edu/departments/makingcase
Community voice for pre-college education

- Next Generation Science Standards
  - Climate science
  - Engineering
  - Human sustainability
  - Scientific argumentation and inquiry
    - Earth systems science

http://www.nextgenscience.org/next-generation-science-standards
Instruction should be inquiry-based, rigorous and empirical, and should prepare students as decision-makers in society.

Completion of a rigorous geosciences course should be required by state departments of education at the high school level.

An Advanced Placement Earth Science course that is rigorous, empirical, inquiry-based and relevant should be established in the geosciences.

College Boards of Admissions and Requirements should admit demonstrably rigorous Earth science courses as fulfilling "laboratory-based course" admissions requirements.

Teacher certification programs should include significant preparation in Earth sciences.

High school guidance counselors must be made aware of geosciences as a viable career option for a wide range of students, and should be aware of colleges and programs for which high school geosciences courses fulfill admission requirements.

The constant presence of climate, energy and natural disaster stories in the media testify to the interest of the US population in these topics, and to the increasing need for citizens to have a basic understanding of the Earth systems. Yet, most Americans' formal education in this vital science ends by the eighth grade. Virtually all of the issues facing human society surrounding sustainability have roots in the Earth sciences. This suggests that a population literate in the geosciences (that is, able to understand and communicate fundamental concepts and make informed and responsible decisions) is essential.

Although the geosciences are of vital national and public interest, and job growth in the geosciences outpaces supply, most U.S. learners end their formal Earth science learning in middle school. College admissions acceptance of high school Earth science courses as a "laboratory-based course" varies (American Geological Institute, 2011), which leads to a lack of perceived value. Less than a quarter of high school students receive instruction in Earth science in high school (compare to Biology at 91-94%) and only about 1% identify physical science or interdisciplinary science (such as geophysics) as their intended major (Gonzales, 2011). Students from racial and ethnic minority groups are not attracted into geosciences degree programs in proportion to their numbers in the population. The number of geosciences jobs is rising while the geosciences workforce nears retirement age and the number of conferred degrees is steady.

The NAGT supports robust Earth science instruction in high school and rigorous training of Earth science K-12 teachers. To that end, NAGT holds the following positions:

- Instruction should be inquiry-based, rigorous and empirical, and should prepare students as decision-makers in society.
- Completion of a rigorous geosciences course should be required by state departments of education at the high school level.
- An Advanced Placement Earth Science course that is rigorous, empirical, inquiry-based and relevant should be established in the geosciences.
- College Boards of Admissions and Requirements should admit demonstrably rigorous Earth science courses as fulfilling "laboratory-based course" admissions requirements.
- Teacher certification programs should include significant preparation in Earth sciences.

- High school guidance counselors must be made aware of geosciences as a viable career option for a wide range of students, and should be aware of colleges and programs for which high school geosciences courses fulfill admission requirements.
**Essays:** Participants at the 2003 workshop wrote essays about the teacher preparation efforts and goals of their institutions. These essays show the wide variety of approaches to preparing future Earth Science teachers currently in use around the country.

**Teacher Interviews:** In order to get a sense of what K-12 teachers are doing in their Earth Science classrooms, we conducted interviews with teachers from different backgrounds, different teaching assignments and different needs.

**Teacher Preparation Courses:** This collection profiles courses at institutions around the country and how they are used to prepare pre-service Earth Science teachers.

**Professional Development Programs:** We developed this collection to highlight different programs from around the country that specialize in helping current teachers expand their expertise in the Earth Science and provide continuing education.

**Teaching Activities:** This collection of activities has been submitted by workshop participants and others that have innovative activities they use in courses that educate future Earth Science teachers.

**Nature of Science Reference List:** This reference list was compiled by Sandra Rutherford of Eastern Michigan University. The references all speak to various aspects of the Nature of Science.
Collaboration opportunities

• Sharing information and email lists
• New media- for smart phones, tablets, smart boards
• Instruments for assessment of learning
• Share practices in online PD
• Sustaining projects