



# National Association of Geoscience Teachers

- 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?

## ***NAGT: Teaching tools and examples in Earth Sciences***

**Susan Buhr**

NAGT Vice President  
AGI Leadership Forum  
September 10, 2012



# National Association of Geoscience Teachers

Raising the quality of and emphasis on teaching the geosciences at all levels and in all venues

- Established 1937
- 1200 members
- Across all contexts



Journal of  
Geoscience  
Education

NAGT Volume 36 Number 5 November 2008

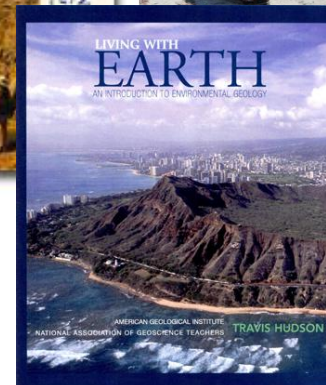
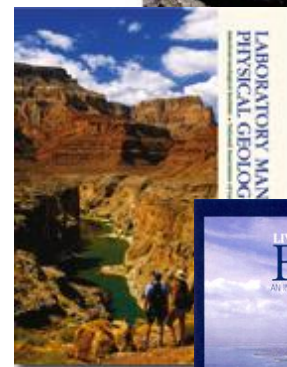


SEPTEMBER 2010 VOL. 1, NO. 1  
NAGT **In The Trenches**

THE NEWS MAGAZINE OF THE NATIONAL ASSOCIATION OF GEOSCIENCE TEACHERS



Teachable Moment



# What is the purpose of media tools?





# 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

Type of institution	College and University	Pre-college
Training emphasis	Science content	Teaching skills
Needs	Teaching skills	More science content
Searching for	<ul style="list-style-type: none"><li>•Images</li><li>•Visualizations</li><li>•Labs</li></ul>	<ul style="list-style-type: none"><li>•Credible activities</li><li>•Appropriate resources</li><li>•Accessible data</li></ul>

# On the Cutting Edge

Professional Development for Geoscience Faculty

About

## 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](#)**



# Student Motivations and Attitudes: The Role of the Affective Domain in Geoscience Learning

## What is the Affective Domain anyway?

This summary was compiled by [Karin Kirk](#), SERC

### Background

The affective domain was first published in 1956 by Krathwohl, Bloom, and Masia, addressing how the domain is addressed in *Taxonomy*, this includes the cognitive domain and the psychomotor domain.

The cognitive domain begins with the acquisition of knowledge, followed by cognitive tasks such as analysis, synthesis, and evaluation.

The psychomotor domain involves physical movement, skills, and motor development. A committee did not address psychomotor domain.

More information

- [Learnin info](#)
- [Benjamin Educati Educati](#)
- [Krathtwe](#)

## Teaching Controversial Topics

This summary was compiled by [Karin Kirk](#), SERC

Some subjects are controversial and involve more of the affective domain. Bowen's Reaction Time exercise for most subjects. The Treaty will elicit a strong reaction. To teach controversial topics, the affective domain topic doesn't sit well with science.

### Affective ch

#### Pre-held beliefs

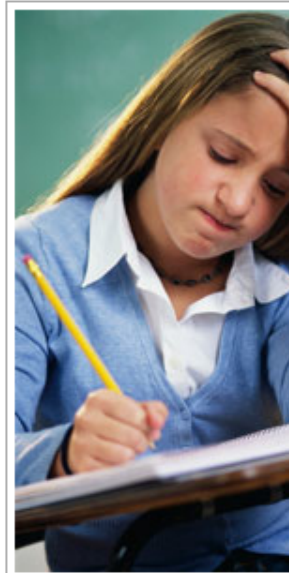
The student may enter the classroom with personal beliefs. These beliefs may be influenced by social experiences and other influences. *teaching allow open to these*

#### Biases and stereotypes

Unfortunately, these biases and stereotypes are often reinforced in controversial topics.

## Self-Efficacy: Helping Students Believe in Themselves

This summary was written and compiled by [Karin Kirk](#), SERC, and contains a [summary](#) of motivation research and pertinent [references](#).



in disappointing academic feedback cycle. ([Bandura](#))

## Motivating Students

This page was written and compiled by [Karin Kirk](#), 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

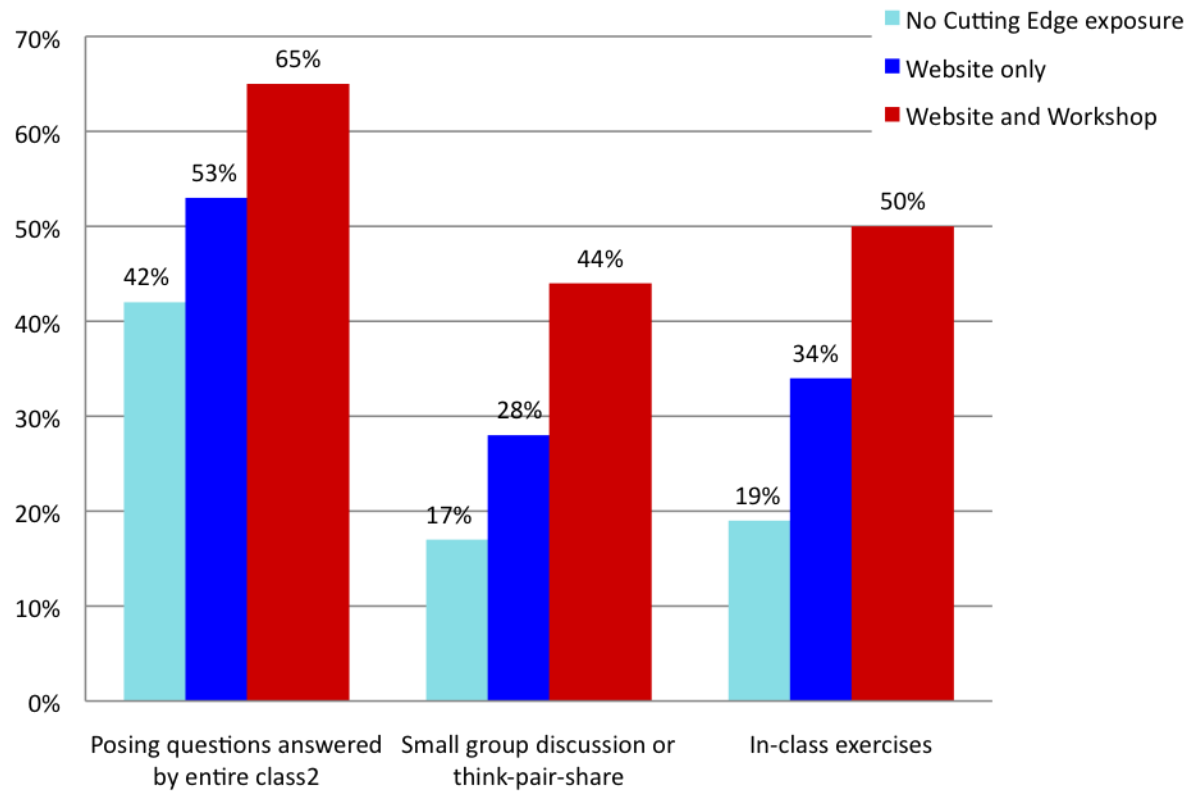
motivation. We may have heard the utterance, "my students are so unmotivated!" and the good news is that there's a lot that we can do to change that.

"Research has shown that good everyday teaching practices can do more to counter student apathy than special efforts to attack unmotivated students."



# Impacts

## Teaching Strategies Used Weekly or Nearly Every Class Introductory Courses



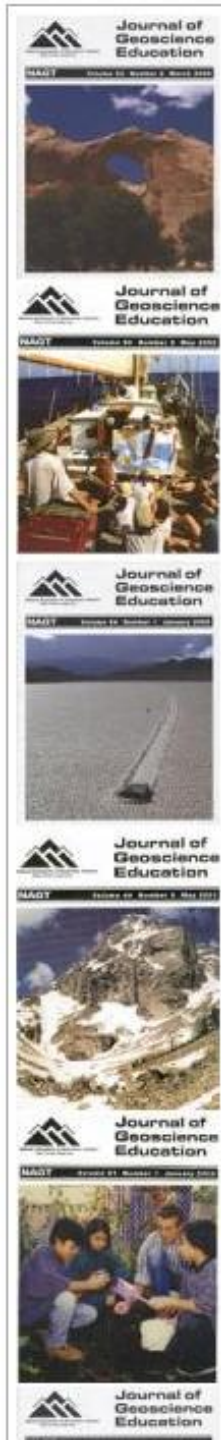


# NAGT Peer-reviewed journal



## Journal of Geoscience Education

- 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*





# National Association of Geoscience Teachers

- Members only glossy “Tips and Ideas” publication

## In the Trenches - July 2012

Volume 2, Number 3

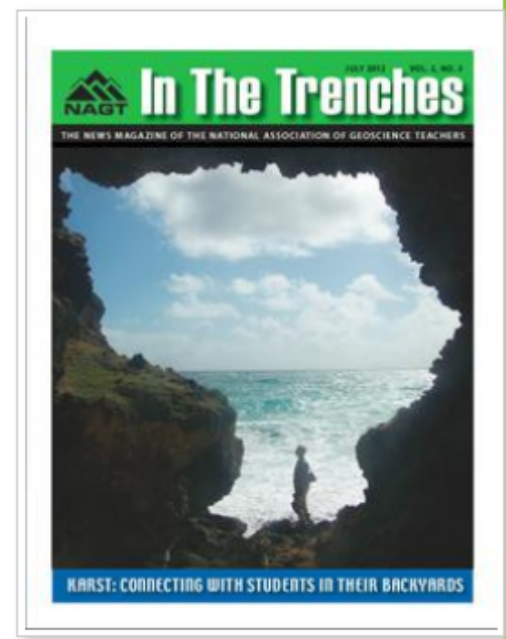
### In This Issue

- [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

Windows Internet Explorer  
http://cleanet.org/clean/educational\_resources/index.html

File Edit View Favorites Tools Help

Windows Live cleanet.org What's New Profile Mail Photos Calendar MSN Share Sign in

Favorites Certificate Error Navigation ... Suggested Sites Free Hotmail Web Slice Gallery muveeNow

Educational Resources

**CLEAN**  
CLIMATE LITERACY & ENERGY AWARENESS NETWORK

CLEAN > Educational Resources

CLEAN  
Teaching Climate & Energy  
**Educational Resources**  
Community  
About CLEAN

## Educational Resources: Search the CLEAN Collection

Scientifically and pedagogically [reviewed](#) digital resources for teaching about climate science, climate change, and energy awareness

[Help](#)

Results 1 - 10 of 91 matches

**Getting to the Core of Climate Change**  
<http://tea.arnoldproject.org/activity/lepik/pettingtoth>  
This is a lab about evidence for past climate change as captured in ice sheets of Greenland and Antarctica. Students investigate climate changes going back thousands of years by graphing and ...

**Seasonal Change on Land and Water**  
[http://www.qlobe.gov/tctq/earth\\_la\\_seaphen\\_s5.pdf?sectio...](http://www.qlobe.gov/tctq/earth_la_seaphen_s5.pdf?sectio...)  
In this worksheet-based activity, students review global visualizations of incoming sunlight and surface temperature and discuss seasonal change. Students use the visualizations to support inquiry on ...

**Ocean Impacts on an El Nino Event**  
[http://mynasadata.larc.nasa.gov/preview\\_lesson.php?passi...](http://mynasadata.larc.nasa.gov/preview_lesson.php?passi...)  
This lesson explores El Nino by looking at sea surface temperature, sea surface height, and wind vectors in order to seek out any correlations there may be among these three variables, using the My ...

**Graphing the Extent of Sea Ice in the Arctic and Antarctic**  
[http://www.windows2universe.org/teacher\\_resources/graphs](http://www.windows2universe.org/teacher_resources/graphs)  
In this activity, students learn about sea ice extent in both polar regions (Arctic and Antarctic). They start out by forming

### Refine the Results

**Climate and Energy Topics**

- Climate System [43 matches](#)
- Causes of Climate Change [21 matches](#)
- Measuring and Modeling Climate [26 matches](#)
- Impacts of Climate Change [27 matches](#)
- Human Responses to Climate Change [22 matches](#)
- Energy Use [30 matches](#)

**Grade Level**

- Middle (6-8) [57 matches](#)
- High School (9-12) [66 matches](#)
- College Lower (13-14) [23 matches](#)
- College Upper (15-16) [7 matches](#)

**Other Categories**

- [Climate Literacy Principles](#) (add this category)
- [Energy Awareness](#) (add this category)
- [Benchmarks for Science Literacy](#) (add this category)

start NAGT ... Webin... Micros... Educat... Search Desktop Internet 100% 3:24 PM

<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.

# InTeGrate

*Interdisciplinary Teaching of Geoscience  
for a Sustainable Future*



Website, project office

Materials  
Development

Implementation  
Programs

Professional  
Development

Assessment

Program Evaluation

## 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



# National Association of Geoscience Teachers

## 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.*

## Related Links

[2009 AGU Heads and Chairs Workshop](#)

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>





# National Association of Geoscience Teachers

[AGT](#) > [Education and Policy](#) > [NAGT Position Statements](#) > [High School Earth Science Instruction](#)

## NAGT

Sections
Divisions
Teaching Resources
Department Resources
<b>Education and Policy</b>
NAGT Position Statements
<b>High School Earth Science Instruction</b>
Teaching Climate Change
Teaching Evolution
Procedure for Approval of Position Statements
Policy Email Lists
Policy Discussions
NRC Framework For New Science Ed Standards
Publications
Programs
Organization
Membership
News and Advertisements

## Position Statement - High School Earth Science Instruction

Drafting Team: Susan Buhr (Cooperative Institute for Research in Environmental Sciences) and Jennifer Wright (School of the Art Institute of Chicago)

Download a copy of the [Position Statement](#) (Acrobat (PDF) 46kB Mar7 12)

The core mission of the National Association of Geoscience Teachers (NAGT) is *"to foster improvement in the teaching of the earth sciences at all levels of formal and informal instruction, to emphasize the cultural significance of the earth sciences and to disseminate knowledge in this field to the general public."*

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.



# Preparing Teachers to Teach Earth Science

**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