NAGT report

Buhr, 092211

Report:

High School Earth Science Instruction Position Statement

The draft Position Statement on High School Earth Science Instruction was posted after our last meeting.

We received 12 comments from members through the discussion board (last comment on July 26) and mailed to the Executive Director. All were positive. The Executive Director sent data from the AGI that has bearing on the opening statement about college admissions acceptance of Earth science courses. Suggestions for improvement ranged, and nearly all were incorporated.

Comments that were incorporated included are described in order of incidence (high to low):

- Change lower case "earth" to "Earth" as a proper noun.
- Replace the word "quantitative" with "empirical".
- Add a bullet about the importance of teacher preparation.
- Improve the opening sentence, which seemed awkward to one reader.

Some suggestions were deemed out of scope for this statement, including recommendations about the importance of geoscience professionals becoming engaged in classrooms, and about the importance of geoscience professionals engaging with decision-makers. Another comment that was not incorporated was about the multiple motivations for entering the field, including intellectual stimulation and relevance to society. These could be considered for inclusion in some fashion if the Executive Committee thinks they are of sufficient merit at this stage.

The position statement with changes is attached at the end of this document. For comparison, see the draft position statement at http://nagt.org/nagt/policy/high-school.html .

Project Kaleidescope

Project Kaleidescope is leading a project designed to integrate sustainability into higher education courses, and to disseminate the work that is done through a coalition of professional societies. I am lead of the Resources Working Group. Thus far we have had one teleconference meeting and have provided input on the entry point, core sustainability concepts, dissemination possibilities and other connections afforded by each of our professional organizations. I have attached my answers to the questions below. Next steps are to establish the action items, timeline and responsibilities of each committee member and to communicate that back to our professional societies.

Publications

At our last meeting we talked of new publications from NAGT. Mike and Aida and I have not talked further about this. We talked of several possibilities at the last meeting. The one that I put forward was about a book on K12 Climate Education strategies geared towards classroom teachers. During our last meeting I spoke briefly with Cathy about the possibility of this being an NAGT book. I did speak briefly with the Executive Director of NSTA, Francis Eberle about the possibility of such a book being a joint NSTA/NAGT project. He said that other books on topics such as evolution were good sellers and he thought there would be a good market. He referred me to their author liaison. I have not followed this up or the other possibilities that arose at our last meeting, so this items requires more discussion to define the best directions.

Appendix 1: Position Statement with comments incorporated:

NAGT Position Proposal: High School Earth Science Instruction

> 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.

Works Cited

American Geological Institute. (2011, May 20). *Geoscience Currents #44.* Retrieved September 22, 2011, from http://www.agiweb.org/workforce/Currents/Currents-044-CollegeAdmissions.pdf

Gonzales, L. and Keane, C. (2011). *Status of the Geoscience Work Force 2011.* Alexandria, VA: American Geological Institute.

Appendix 2: PKAL request for answers to questions about entry point, concepts and dissemination mechanisms

1. Given the list of sustainability topics/concepts with which we are starting, where are the entry points from the perspective of your discipline?

Entry points for geoscience education overlap with those of environmental science. From the list above, the entry points include:

- Carbon neutrality: relates to idea of sources and sinks
- Ecological footprint (or carbon footprint for climate): again relates to sources and sinks on an individual basis, and to limits on natural resources relative to those who need them.
- Tragedy of the commons-related to limits
- Renewable resource-related to natural cycles, recharge rates, the sun as the main source of energy.

- Risk assessment-related to tipping points, human interactions with the environment (example building codes in earthquake zones)
- Shifting baseline-example-every decade there is a new "climate normal" to make a new 30 year baseline; humans shift to provide more ecosystem services previously provided by natural systems.
- Sustainability-idea of cycles, limits, humans interaction with the environment

The big entry point is within systems thinking. Earth systems big ideas include:

Earth Science Big Ideas:

- The Earth is a System of Systems
- The Flow of Energy Drives the Cycling of Matter
- Life, Including Human Life, Influences and is Influenced by the Environment.
- Physical and chemical principles are unchanging and drive both gradual and rapid changes in the Earth system.
- To Understand (Deep) Time and the Scale of Space, Models and Maps are Necessary

Taken from: Duggan-Haas, D. (2010) SYNTHESIZING EARTH SYSTEM ESSENTIAL PRINCIPLES: WHAT EVERY CITIZEN NEEDS TO KNOW. North American Association for Environmental Education Annual Meeting, Buffalo, New York.

These are a compilation of overlapping ideas within geoscience literacy frameworks including Ocean, Climate, Atmosphere and Earth (mostly geology) literacy.

The other topics in the list (triple bottom line, life cycle analysis) fall more within social aspects such as economic. Many faculty do include integration of these topics with geoscience courses but I don't think they are as core to the field as the others. I do think they are important for the purpose of teaching students how to incorporate other values and considerations into decisions and not only the science.

2. Which contexts, topics and concepts are naturally aligned with the goals of sustainability education?

Systems focused courses, climate change, water resources, food and energy systems with big geoscience foci. I tend to see sustainability education everywhere. I am quite sure ASHE has done an analysis of where sustainability is taught. I have data from our CLEAN project about within which courses undergraduate faculty are teaching climate and energy topics.

3. What is your society already doing that could be engaged for this effort: resource collections, established metadata and cataloguing tags, dissemination mechanisms?

CLEAN collection is a NAGT partner project, SERC has resources, established metadata and cataloguing tags for geoscience but I'm not sure about sustainability (have an email out to ask), Cutting Edge workshops, and guides to SERC collection. SERC has a big reach into the geoscience faculty. The CLEAN collection focuses on climate and energy focused grades 6 through undergrad.

4. What do your disciplinary faculty find compelling when it comes to adopting new material (Industry needs, student motivators, interesting research questions)?

I am not sure but I think relevance to students (local issues) and student research opportunities. I know faculty need resources for quantitative skills, especially at the remedial level.

5. In what other projects or communities are you involved that are relevant to this effort? The CLEAN project, American Geophysical Union, K12 teacher networks, Climate Literacy Network. Formerly with city sustainability advisory board