

Education and Human Resources

ED51A MCC: 130 Friday 0830h

The Participation of AGU Scientists in Support of K-14 Education and Public Outreach I (joint with B, OS, SA, PA)

Presiding: C A Morrow, Space Science Institute; S Pompea, National Optical Astronomy Observatory

ED51A-01 0835h INVITED

National Science Foundation Facilitation of AGU Scientists' K-14 Education and Outreach Activities

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The National Science Foundation encourages the participation of geoscientists in K-14 education and outreach and provides support for that participation through a wide variety of programs. At the most general level, NSF requires that scientists describe the broader impacts of their research in their proposals. While broader impacts are not restricted to education and outreach, this requirement has encouraged many scientists to consider opportunities for K-14 education and outreach.

Many NSF-wide programs provide financial support for K-14 education and outreach. Some are long-standing programs like Research Experiences for Undergraduates (REU), which have been used effectively by the geoscience community to introduce undergraduates to our field. Other programs, like CAREER, encourage faculty to develop innovative teaching and curricular approaches and to relate them to their research program.

The Education and Human Resources Directorate (EHR) of NSF provides funds for a variety of undergraduate education improvements, and for elementary and secondary education activities. EHR also provides opportunities for informal education that have been used by the geoscience community to develop museum exhibits, IMAX films, television programs, and other high visibility outreach activities.

The Directorate for Geosciences (GEO) holds competitions in the Geoscience Education Program and Opportunities to Enhance Diversity in the Geosciences that provide funds focused on development in our own field. Other specialized competitions, like awards associated with the Center for Ocean Science Education Excellence, have targeted the specific K-14 education and outreach needs of portions of our community.

Finally, GEO has facilitated the development of the Digital Library for Earth System Education (DLESE) that has established a digital portal to age-appropriate, peer-reviewed curricular material for teachers.

ED51A-02 0850h

One Model for Scientist Involvement in K-12 Education: Teachers Experiencing Antarctica and the Arctic Program

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Scientists involved in the NSF-funded Teachers Experiencing Antarctica and the Arctic (TEA) Program integrate a K-12 science teacher into their polar field

project. Objectives of the program include: having the science teacher immersed in the experience of research; 2) through the teacher, leveraging the research experience to better inform teaching practices; and 3) sharing the experience with the broader educational and general community. The scientist - or qualified team member - stays involved with the teacher throughout the program as a mentor.

Preparation of the teacher involves a week-long orientation presented by the TEA Program, and a two week pre-expedition visit at the scientist's institution. Orientation acquaints teachers with program expectations, logistical information, and an overview of polar science. While at the scientist's institution, the teacher meets the team, prepares for the field, and strengthens content knowledge. In the field, the teacher is a team member and educational liaison, responding to questions from students and colleagues by e-mail, and posting electronic journals describing the research experience. Upon return, the teachers work closely with colleagues to bring the experience of research into classrooms through creation of activities, design of longer-term student investigations, and presentations at scientific, educational, and community meetings. Interaction with the scientific team continues with a visit by the scientist to the teacher's classrooms, collaboration on presentations at scientific meetings, and consultation on classroom activities. In some cases, the teacher may participate in future expeditions.

The involvement by scientists in mentor relationships, such as those of the TEA Program, is critical to improving science education. Many teachers of science have not had the opportunity to participate in field research, which offers valuable first-hand experience about the nature of science, as well as about specific content. The value to the scientist lies in deepening the understanding of current science education, increasing exposure to new ways to communicate information, and developing a path to having the research shared with the classroom and community via the TEA teacher's outreach. This long-term interaction between a scientist and a teacher can result in meaningful impact through increasing depth of understanding - not just about science content, but about the process of science. Equipped with this understanding based on experience, the teacher can multiply the impact with colleagues and students.

URL: <http://tea.rice.edu>

ED51A-03 0905h

NASA Earth Science Enterprise Education

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NASA Earth Science Enterprise is taking active steps in supporting NASA's mission:

- To understand and protect our home planet
- To explore the Universe and search for life
- To inspire the next generation of explorers as only NASA can.

The role that scientists and engineers play in the Enterprise's educational endeavor will be discussed.

ED51A-04 0920h

EOS Aura's Education and Public Outreach Program - A Lesson for a Scientist.

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NASA's EOS Aura atmospheric chemistry mission is designed to answer three basic questions about the Earth's atmosphere: a) Is the Earth's ozone layer recovering? b) Is air quality changing? c) How is the Earth's climate changing? The Aura Project agreed to support an ambitious EPO program early in the mission to establish an Aura presence with the public prior to and after launch. The Aura EPO program's overarching objectives is to inform students, our peers, the general public, policy makers and industry. One of my roles as Aura Deputy Project Scientist was to develop a plan, cost, and schedule through launch with these objectives. Our goal was to have the maximum number of outreach contacts for the least cost. This meant taking advantage of well established and proven EPO enterprises. The selected Aura EPO partners include GLOBE, the American Chemical Society, the Smithsonian Institution, Environmental Defense, and NASA's Earth Observatory websites. Managing these tools to convey the Aura message through launch became an over arching task.

A Project Scientist's role for a large NASA space mission has many facets and running an EPO program has several challenges. The first success came with bringing on-board experienced Outreach personnel familiar with NASA missions. This step was invaluable

in launching Outreach projects since they did not necessarily conform to the NASA way of conducting research and flight missions. "Leveraging" is key element in Outreach programming and we found many avenues among our partners to put this to full use particularly since atmospheric chemistry is an important and sometimes controversial environmental issue. It was gratifying to see, as a scientist, our Outreach contacts get excited about the subject when explained in a personal way. Another important challenge for a scientist is the balance of time spent between research and Outreach. Each requires creativity and dedication of time and both have rewards that are very complimentary. Fortunately NASA, as an agency, provides a lot flexibility in how its personnel manages this balance since EPO has now become part of its mission.

<http://eos-aura.gsfc.nasa.gov>

URL: <http://eos-aura.gsfc.nasa.gov>

ED51A-05 0935h INVITED

Strategies for Engaging NASA Space Scientists in K-14 Education and Public Outreach

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The NASA Office of Space Science (OSS) has made a significant commitment to increase scientist participation in Education and Public Outreach (EPO), with a focus on providing tools and assistance for educators in K-14 education and for public informal education. The general goals are to use NASA scientific discoveries and mission results to contribute to the technical and scientific literacy of the nation, to inspire youth, and to achieve significant and sustained enhancement of K-14 education. The participation of AGU scientists in EPO activities is vital to achieving these goals. This participation by individual scientists is often voluntary, but it can be funded as supplements to research grants or directly by OSS missions, which are now required to spend a few percent of their total budget on EPO. Scientists can provide inspiring role models for students, be powerful partners with teachers, work with community-based organizations and museums, and help assure the scientific accuracy of educational materials. The Sun Earth Connection Education Forum (SECEF) is supported by OSS to facilitate scientist involvement in EPO. SECEF coordinates national programs for broad audiences that highlight solar and geospace missions and research programs. Examples of SECEF high-visibility national events are Sun-Earth Day and Eclipse 2001. These events involved more than 100 space scientists in schools, museums, and other venues across the nation, including members of minority professional societies, such as the National Society of Black Physicists. We will discuss lessons learned and future opportunities for scientist participation.

ED51A-06 0950h INVITED

The Education and Public Outreach Committee of the AGU Space Physics and Aeronomy Section: Supporting AGU Scientists in their Educational Endeavors

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This paper will describe the organization, activities, and plans of the Education and Public Outreach (EPO) Committee of the AGU Space Physics and Aeronomy (SPA) section. The authors are currently serving as SPA President and SPA EPO committee chair. They are building on a valuable precedent and legacy established by previous SPA leaders. The SPA EPO Committee is the longest standing of its kind within any of the AGU sections. The EPO Committee chair is a full, voting member of SPA Executive Council and serves as a Section representative to the AGU Committee on Education and Human Resources (CEHR). Committee membership is comprised of representatives from major research institutions and government labs

with a significant solar/space weather EPO effort. The Committee convenes conference sessions in which AGU scientists in all Union disciplines can report on their EPO activities and hear the perspective of leading advocates on the EPO involvement of the science community. These sessions have done pioneering work in featuring and encouraging AGU scientists' participation in the realms of K-12 education and informal education. The SPA EPO Committee is also planning to experiment with embedding a few, well-chosen educational papers in SPA research sessions. In addition, we plan to do more to facilitate the participation of SPA scientists and scientist-educators in support of Union tutorials, teacher workshops, sessions on diversity, and other AGU EPO activities.

ED51A-07 1025h INVITED

Improving Diversity and Educational Outreach at the K-14 level: A Call to Action for the AGU Membership

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In 2002, the Subcommittee on Diversity (SD) of the Committee on Education and Human Resources (CEHR) submitted a Diversity Plan to the leadership of AGU. This plan outlines specific programs and goals that AGU can follow to help improve diversity in the Earth and space sciences.

Diversity issues are key components to improve the human resource potential in the geosciences. As women are the majority population, and racial and ethnic minorities are experiencing the largest growing segment of the United States population, it is within our best interest to actively recruit and retain these populations into our dynamic fields of study.

The SD recognizes that the strength of the AGU lies within its membership. Composed of some of the brightest and talented scientists in the world, the AGU members are leaders and pioneers in our understanding of the Earth System. Yet, many, if not most, people within underrepresented communities are not aware of the relevance that the Earth and space sciences play in their lives.

In this discussion, we will discuss the importance of the AGU membership in the Diversity Plan. In addition, we will outline specific things that AGU members can do to improve access of US students and citizenry to Earth and space science education. These steps require that AGU members become active advocates in the public, especially at the K-14 level.

ED51A-08 1040h INVITED

NCAR's Education and Outreach Program

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In January 2001, NCAR hosted the NSF sponsored "Workshop on Earth System Education Partnerships with Research Institutions." This workshop, attended by leading scientists and educators from across the country, focused on defining the role of scientific research institutions such as NCAR in education and outreach. Recommendations coming from this workshop provided guidance for expansion of NCAR's educational activities from the strictly undergraduate, graduate and professional arena into public outreach and K-14 education. In the nearly two years since the workshop, NCAR has introduced several major new on-going educational efforts, in collaboration with the UCAR Office of Education and Outreach. The new annual Summer Undergraduate Leadership Workshop, initiated in June 2002, provides promising undergraduates a glimpse of state-of-the-art research underway at NCAR and considers concepts of leadership in the sciences. The new annual Geoscience Education Workshop on Climate and Global Change, initiated in July 2002, provides professional development for skilled teacher trainers on concepts in climate and global change science, human impacts, mitigation, and policy considerations. This winter NCAR will be unveiling its new Education and Outreach Website, targeting the public, students, and educators with information about NCAR science, visualizations, activities, events, and opportunities. Finally, during NCAR's

Mesa Lab refurbishment, we are busy updating the exhibits in the Mesa Lab, including the installation of a new major exhibit on Climate and Global Change, opening to the public in Summer, 2003. These activities are all supported by an ongoing evaluation program, which helps us to continually refine and improve our education and outreach efforts. This talk will describe both the new and traditional elements of NCAR's Education and Outreach Program.

ED51A-09 1055h INVITED

The CIRES Outreach Program: Contributions to Education by an Environmental Science Research Institute

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The CIRES Outreach program contributes to education by making CIRES resources of cutting-edge science and expertise available to educators, students and school districts. CIRES scientists conduct outstanding interdisciplinary studies of the Earth, in research areas including solid earth processes, ocean sciences, polar processes, climate studies, regional water assessment and more. The CIRES Outreach program was established in 1996, in order to demonstrate CIRES commitment to serving the larger community, to meet funding agency requirements and to expand our contributions to the University mission.

CIRES Outreach projects seek to maximize our impact by focusing on professional development and long term partnerships. Our work with teachers, prospective teachers and school districts allows us to respond to the stated needs and goals of our partners, increasing the likelihood that our efforts will result in classroom implementation. In addition to our professional development work, we further contribute to the community and to CIRES by providing education components for research proposals, brokering student research mentorships, hosting a National Ocean Sciences Bowl site, and supporting scientists outreach interests and needs. Collaborative involvement by researchers is a hallmark of CIRES Outreach projects.

Personnel within the CIRES Outreach program possess a variety of skills and credentials. The bulk of the staff has been composed of Ph.D. level scientists, with certified school teachers, School of Education doctoral students, and administrative support enhancing our ability to understand and operate within formal education systems.

This spectrum of expertise within the program allows us to bridge the worlds of scientific research, classroom science education and education and outreach social science research. To best use this ability, CIRES Outreach projects are chosen so that our contributions serve a real and unique need within science education.

URL: <http://cires.colorado.edu/~k12>

ED51A-10 1110h

A Decade on the Global Change EPO Trail

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The Aspen Global Change Institute (AGCI) offers a variety of approaches to enhance K-12 Earth systems science education through pre- and in-service educator professional development workshops, materials development, and experiences for scientists on roles they can play in education and outreach. Partnering institutions have included the Space Science Institute, NASA Earth Science Enterprise, and NSF Geosciences. Here we review approaches and lessons learned from three projects. 1) The Ground Truth Studies teacher workshops and the development of the Ground Truth Studies Teacher Handbook, funded as a cooperative agreement with NASA and other sources. This project was developed with Earth system scientists, environmental education curriculum developers, K-12 teachers and was piloted in several states. The project culminated in the development of the teacher handbook which includes primers on global change, remote sensing, elementary and secondary level hands-on activities, and resources. This publication has been utilized in conjunction with other teacher training programs or as a stand-alone resource for teachers. 2) PESTO (Pre- and In-Service

Earth Science Training Opportunity) funded by NASA, a residential week-long intensive experience for pre- and in-service teachers offered for graduate and undergraduate credit. The PESTO faculty included a senior research scientist, an environmental educator/curriculum developer, and an EPO specialist. Content included an overview of global environmental change with an emphasis on climate and atmospheric chemistry and a review of online and CD resources relevant to elementary and secondary Earth systems topics. Visiting scientists engaged the group in the process of science and issues associated with science in society. 3) Workshop on K-12 Education for Geoscientists, a NSF/Geosciences sponsored project was a mini-workshop embedded within one of AGCI's interdisciplinary science meetings on a topic in global change. The scientists assembled for the advanced science discussions had the opportunity to learn about the status of science education in the US, science reform efforts and development of the National Standards. They also had the opportunity to discuss with educational leaders at the national level the rationale of these strategies, to work through exemplary hands-on science activities and to have free-ranging discussion of their own educational experiences and what supported and detracted from their pursuit of careers in science. Participants also explored a wide range of roles they can play in supporting science education at the local to national levels. The above projects will be discussed in the context of engaging the research community in interdisciplinary work.

ED51A-11 1125h INVITED

Education and Outreach Opportunities in New Astronomical Facilities

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Astronomy presents extraordinary opportunities for engaging young people in science from an early age. The National Optical Astronomy Observatory (NOAO), supported by the National Science Foundation, leverages the attraction of astronomy with a suite of formal and informal education programs that engage our scientists and education and public outreach professionals in effective, strategic programs that capitalize on NOAO's role as a leader in science and in the design of new astronomical facilities. The core of the science education group at NOAO in Tucson consists of a group of Ph.D. level scientists with experience in educational program management, curriculum and instructional materials development, teacher/scientist partnerships, and teacher professional development. This core group of scientist/educators hybrids has a strong background in earth and space science education as well as experience in working with and teaching about the technology that has enabled new astronomical discoveries. NOAO has a vigorous public affairs/media program and a history of effectively working locally, regionally, and nationally with the media, schools, science centers, and planetaria.

In particular, NOAO has created successful programs exploring how research data and tools can be used most effectively in the classroom. For example, the Teacher Leaders in Research Based Science Education explores how teachers can most effectively integrate astronomical research on novae, active galactic nuclei, and the Sun into classroom-based investigations. With immersive summer workshops at Kitt Peak National Observatory and the National Solar Observatory at Sacramento Peak, teachers learn research and instrumentation skills and how to encourage and maintain research activities in their classrooms.

Some of the new facilities proposed in the recent decadal plan, Astronomy and Astrophysics in the New Millennium (National Academy Press), can provide extended opportunities for incorporating research into the classroom. An example is the Large Synoptic Survey Telescope, which will put within public reach on a weekly basis a digital survey of the changing sky. The Giant Segmented Mirror Telescope is a key ingredient in the search for extrasolar planets and the National Virtual Observatory will allow unprecedented data access using powerful data mining and visualization tools. NOAO scientists and educators are designing educational programs around these new initiatives in order to capitalize on their national and international educational value. Our most significant challenge is to find ways to consolidate and institutionalize successful prototype and experimental astronomy education programs into permanent national resources for the earth and space science educational community. If we are successful, there is an enormous potential for future research discoveries to be made from the classroom and for NOAO educational programs to serve as models for other science research institutions.