ED52A MCC: Hall D Friday 1330h

Strategies for Improving Earth and Space Science Education Posters

Presiding: **M Ruzek,** Universities Space Research Association**; M Smith,** American Geological Institute

ED52A-0001 1330h POSTER

Bringing Research on Learning to the Earth Sciences: A Workshop Report

David W. Mogk[1] (406 994-6916; mogk@montana.edu)

Cathryn A. Manduca[2] (507 646 7096; cmanduca@carleton.edu)

Neil Stillings[3] ((413) 559-5513; nstillings@hampshire.edu)

[1]Dept. Earth Sciences, Montana State University, Bozeman, MT 59717, United States

[2]Science Education Resource Center, Carleton College, Northfield, MN 55057, United States

[3]Dept. of Psychology, Hampshire College, Amherst, MA 01002, United States

This summer, leaders in geoscience education research, education research in related science disciplines, and the cognitive sciences came together with funding from the NSF and the Johnson Foundation to initiate the development of a community engaged in applying learning science to the geosciences. Main topics addressed at the workshop included: articulation of geoscience learning goals; understanding vast and minute spatial and temporal scales; teaching and learning about complex systems; representation and visualization of multidimensional data; interaction of observation, theory, modeling, and experiment in geoscience methodology; ways of knowing; and learning environments. Workshop participants concluded that the geosciences play several key roles in education including developing students? understanding of the nature of science in general and geoscience in particular; providing opportunities to integrate skills and learning from other sciences and mathematics in context; and allowing students to apply scientific understanding to societal or personal decision making. Participants identified several priority research areas of high interest to both learning science and the geosciences:

•Visualization: how do people look at, interpret and describe geoscience images

•Representation: how do we understand and represent things abstract, unseen, and beyond everyday human experience

•Space: how do we effectively teach the spatial reasoning skills fundamental to studying the Earth (e.g. distance, shape)

•Learning in the field: how do people observe, interpret, and draw conclusions from natural systems

•Deep time: how do we effectively teach about deep time, rates, and the importance of history in the evolution of the earth

•Expert-novice relationships: what characterizes geoscience expertise; how do geoscientists learn things and draw conclusions

•Complex systems: How do we teach and learn about complex systems

•Models: How do we teach about models and use them to learn about the Earth (creation, use, analysis).

Workshop recommendations for future work include: 1) dissemination of existing research on learning to colleagues in the geosciences, and of research opportunities in geoscience classrooms to learning scientists; 2) professional development of current and future teachers and faculty to develop their capacity to observe student learning, and to design and evaluate their teaching practices; and 3) development of collaborations between geoscience and learning scientists to address priority research areas. Full information about the workshop and its results can be found at http://serc.carleton.edu/research_on_learning/workshop02

ED52A-0002 1330h POSTER

Developing Strong Geoscience Programs and Departments

R. Heather Macdonald[1] (757-221-2443; rhmacd@wm.edu)

Cathryn A Manduca[2] (507-646-7096; cmanduca@carleton.edu)

[1]College of William and Mary, Department of Geology PO Box 8795, Williamsburg, VA 23187-8795, United States

[2]Carleton College, Science Education Resource Center, Northfield, MN 55057, United States

Strong geoscience programs are essential for preparing future geoscientists and developing a broad public understanding of our science. Faculty working as a department team can create stronger programs than individual faculty working alone. Workshops sponsored by Project Kaleidoscope (www.pkal.org) on departmental planning in the geosciences have emphasized the importance of designing programs in the context of both departmental and student goals. Well-articulated goals form a foundation for designing curriculum, courses, and other departmental activities. Course/skill matrices have emerged as particularly valuable tools for analyzing how individual courses combine in a curriculum to meet learning goals. Integrated programs where students have opportunities to learn and use skills in multiple contexts have been developed at several institutions. Departments are leveraging synergies between courses to more effectively reach departmental goals and capitalize on opportunities in the larger campus environment.

A full departmental program extends beyond courses and curriculum. Studies in physics (National Task Force on Undergraduate Physics, Hilborne, 2002) indicate the importance of activities such as recruiting able students, mentoring students, providing courses appropriate for pre-service K-12 teachers, assisting with professional development for a diversity of careers, providing opportunities for undergraduates to participate in research, and making connections with the local industries and businesses that employ graduates. PKAL workshop participants have articulated a wide variety of approaches to undergraduate research opportunities within and outside of class based on their departmental goals, faculty goals, and resources. Similarly, departments have a wide variety of strategies for developing productive synergies with campus-wide programs including those emphasizing writing skills, quantitative skills, and environmental studies. Mentoring and advising activities are becoming more central to many departmental programs and can effectively draw on campus, alumni, and industry resources. Attention to the role and reputation of the department on campus is important in creating a supportive climate for departmental activities. The challenges of creating a strong program can be most effectively met using a team approach that capitalizes on the strengths of every department member.

ED52A-0003 1330h POSTER

Teaching Quantitative Skills in a Geoscience Context

Cathryn A Manduca[1] (507 646-7096; cmanduca@carleton.edu); R Heather Macdonald[2] (rhmacd@wm.edu); Mary Savina[1] (msavina@carleton.edu); Janet Andersen[3] (jandersen@hope.edu); Sam Patterson[1] (spatters@carleton.edu); Margie Mason[2] (mmmaso@wm.edu)

[1]Carleton College, 1 North College Street, Northfield, MN 55057

[2]College of William and Mary, Williamsburg, Williamsburg, VA 23185

[3]Department of Mathematics, Hope College, Holland, MI 48422

New attention is needed to the ways in which quantitative skills are taught in the geosciences. At the introductory level, geoscience courses play an important role in teaching students the basic abilities needed to use and understand quantitative information. These skills are becoming more important as quantitative information is increasingly used by all citizens to make informed personal choices, for financial success, and to guide our democracy (Mathematics and Democracy, Steen, 2001). Mathematical skills are also becoming increasingly fundamental to success as a practicing geoscientist requiring modification of teaching within the major. An integrated approach developing synergies between mathematics, geoscience and other science courses will be most effective in enhancing students learning in these areas. This summer 40 mathematics and geoscience faculty met at Carleton College for 5 days to explore the ways in which geoscience and mathematical approaches to teaching skills complement each other and to develop materials that reflected the strengths of both approaches. Primary outcomes included 1) new appreciation of the importance of incorporating multiple representations, in-depth problems, contextual examples, and group work in teaching mathematical and quantitative skills, 2) a preliminary list of skills that can form a basic vocabulary for discussions of course content, 3) ten resources developed jointly by mathematicians and geoscientists for use in courses, and 4) new collaborations between geoscientists and mathematicians both on campuses and beyond. Full information about the workshop and its results are available at http://serc.carleton.edu/quantskills/events/NAGT02

URL: http://serc.carleton.edu/quantskills

ED52A-0004 1330h POSTER

Educational Geophysics at INGV, Rome (Italy)

. DiDa Working Group INGV (gli_dida_divulg@ingv.it)

Istituto Nazionale di Geofisica e Vulcanologia, Via di Vigna Murata, 605, Rome 00143, Italy

Italy is a country prone to Earth phenomena such as earthquakes, volcanic eruptions, floods and landslides that left a trace in the memory of people. About 60% of the Italian territory is classified in the current seismic hazard maps, and large cities as Neaples and Catania are located close to the two largest active volcanoes of Europe (Mt. Vesuvius and Mt. Etna, respectively). Nevertheless, school programs are often inadequate about the natural hazards of the country. For this reason there are many requests from schoolteachers to visit with their classes the academic Institutions and to attend geophysical talks. The working group for educational activities of the Istituto Nazionale di Geofisica and Vulcanologia promotes and realizes Earth science outreach programs devoted to increase the knowledge of geophysical topics. The educational activity is one of the most important tasks of our Institution together with the research activities and the 24-hours survey of the Italian Seismic Network. The INGV hosts in its headquarter of Rome many visits of primary, secondary and high schools with an increasing demand year by year. Every year about 3,000 students visit our Institute over more than 60 open-days, and we participate to exhibitions and outreach projects organized by several Institutions.

We show here what has been done at INGV for the geophysical education, underlining the problems and the successes of these activities. We describe also an educational project developed together with a teacher's team of secondary-school. Aim of this experience was to stimulate the interest of 12-year-old kids to unfamiliar arguments like seismology. The class was introduced to physical topics as waves and wave propagation by means of simple experiments. Then they visited the INGV were the research activities were shown, with emphasis on seismological studies; they were also thought how the Italian Seismic Network monitors earthquakes and how to use the P and S waves for their localisation. In a third stage the class was divided into working groups, applying the taught concepts by means of a seismic survey activity simulation. An emergency situation was reproduced, with kid-seismologists working on the epicentre localisation and alarming the Civil Protection, followed by a press conference of kid-journalists.

ED52A-0005 1330h POSTER

A German Geophysics School Project First steps to bring geophysical topics to schoolclasses

Simon Schneider (sschneid@geophysik.uni-frankfurt.de)

Johann Wolfgang Goethe University, Institute of Meteoroloy and Geophysics Feldbergstr. 47, Frankfurt am Main 60323, Germany

In Germany Geophysics is a science with almost none or a bad reputation. People do not know to distinguish between Geophysics, Geography and Geology. In order to change the public view on Geosciences, a School Project Geophysics' is going to be created at the Institute of Meteorology and Geophysics, Johann Wolfgang Goethe University, Frankfurt, which will offer geophysical ideas, methodes and scientific results to schoolclasses.

After researches like PISA or TIMSS (third international Math and Nature-Science test) new concepts in education will be required. Interdisciplinary tasks are demanded by national and international commissions.

The School Project Geophysics' will be created to bring geophysical themes and results of scientific research into schools. One Day- or one Week-Workshops will help to publish geophysical contents in close cooperation with Physics - and Geography - teachers.

Hands-on experiments (for advanced pupils) like refraction-Seismics or Magnetic measurements will lead students closer to scientific work and will help to establish personal interests in Earthsciences. Working with personally produced datasets will show the basics of inversion theory and point out the difficulties in creating models. Boundaries of data interpretation (the plurality of variables needed) will teach the school children to see scientific and statistic predictions and declarations more criticaly.

Animations and Videos will present global examples (for example of volcanoes or Earthquakes) and lead over to regional sites. Excursions to these sites will help to show fieldwork methods and its problems and will convince to take a different look on topography and landscapes.

All necessary utilities (Animations, Videos, Pictures and foils) will be offered to teachers in an online-data base which will be installed and managed by the project. Teachers and pupils might get easily into contact with Scientists to discuss geoscientific items. Further on extensions to geographic and geologic topics

could be additional targets to this project.
A poster will show the structure of one examplary workshop. This poster might stimulate to discuss experiences and further ideas.

ED52A-0006 1330h POSTER

Hands-on Symmetry, Building and Using 3-D Crystal Models in Mineralogy

Kevin Cole (6168953791; colek@gvsu.edu)

Grand Valley State University, Geology Department 1 Campus Drive, Allendale, MI 49401

Symmetry has historically been the most difficult subject in mineralogy and because so much of the science of mineralogy and crystallography builds on the fundamentals of form and symmetry, it is essential students understand it well. I concluded in recent years that better manipulatives might hold the key to better student comprehension.

Mineralogy lab exercises related to symmetry typically involve the use of line drawings of 3-D crystal shapes sometimes augmented with a selection of small wooden models. Many students find the line drawings difficult to envision as 3-D solids. This makes the leap to identifying symmetry elements almost impossible for them and very time consuming for the instructor. The few line drawings for which models were available to my students were readily understood. Following the purchase of a new chop saw, I discovered that it is easy to cut most crystal models from scrap lumber and spent two weeks calculating, cutting, and finishing wooden models. For each of the line drawings used in my symmetry labs two models were cut, 200 models total. Models were also cut to show form development, distorted growth, enantiomorphism, and twinning. The models were cut to a final size of 5 to 15 cm and can be written on with chalk. The large model size and chalkability allowed students to more easily identify, mark, and erase mirrors, axes, forms, etc.

Use of these models resulted in 50% less lab time needed in teaching the concepts of symmetry and form and 75% less time for students to complete the exercises. Scores on the symmetry labs averaged 55% to 65% in 1999-2001. The Fall 2002 averages were 85% and the errors made were much more trivial in nature, a dramatic improvement indeed.

ED52A-0007 1330h POSTER

Exploring the Planets: A Mathematical Journey

MacGregor B. Campbell[1] (mbc5@duke.edu)

Catherine L Johnson[2] ((858) 822-4077; cljohnson@ucsd.edu)

[1]Davis Middle School / Teach For America, 641 Poplar Ave, Compton, CA 90212, United States

[2]IGPP, Scripps Institution of Oceanography, 9500 Gilman Drive, La Jolla, CA 92093-0225, United States

We have developed a series of lessons, designed to teach and reinforce mathematics through lessons about Earth and the bodies that most resemble it in the solar system: Mars, Venus, and the Moon. All lessons are based on California mathematics standards and also cover some Earth science content standards. The overall goal is to achieve cross-curricular learning objectives by showing how math and science work together. While the lessons are designed for a 7th grade math class, they could easily be adapted for a science class, or even modified for different grade levels. The lessons are designed to make recent discoveries in planetary science accessible to students in under-resourced schools.

The set of five lessons makes up one unit to be taught consecutively. All the lessons are designed for the alternate day 1 hr and 50 min block scheduling, however the activities could be divided up over two days to accommodate a traditional schedule. There are a total of five lessons, plus a unit test and alternative assessment activities to be given on the sixth day of the unit. In a normal block schedule, the unit should take three weeks. The lessons are available on the web at http://mahi.ucsd.edu/johnson/mathjourney.

Each lesson plan comprises the lesson objectives (along with the relevant California 7th grade mathematics standards), a warm-up activity, a vocabulary list (containing words that may be unfamiliar to students, especially those who are learning English), materials required for the class, the lesson structure plus sample dialogue, and in-class and homework activities and worksheets. The in-class activities and worksheets give students the opportunity to master concepts, and can also be useful as a formative assessment tool for the teacher. The mid-unit quiz, final test, and final project can be used as summative assessments.

The lessons will be tested this fall by the first author at Davis Middle School, Compton, CA. They will also be disseminated among Teach For America corps members to enable a broader impact in a range of urban and rural under-resourced schools.

We have also been using the capabilities of the Scripps Institution of Oceanography Visualization Center to produce fly-throughs of large planetary data sets. These are exported as QuickTime movies, making them available as educational tools.

URL: http://mahi.ucsd.edu/johnson/mathjourney.

ED52A-0008 1330h POSTER

Student Hand-held Polarimeter Project

James Frost[1] (718-270-6454)

Shermane Austin[2] (718-270-6454; shermane@verizon.net)

Leon Johnson[2] (718-270-6454)

[1]LaGuardia Community College, CUNY, 41st Road, Long Island City, NY 11225

[2]Medgar Evers College, CUNY, 1150 Carroll Street, Brooklyn, NY 11225

An inter-disciplinary undergraduate student research project is underway, focusing on the feasibility of using hand-held polarimeters to obtain information about the size and composition of tropospheric aerosol particles in the Earth's atmosphere. Such information would provide insight into the solar radiation budget, as these aerosols are known to reflect incoming solar radiation back into space and in the process generate a cooling effect on the earth's surface. The impact of global warming can not be completely understood unless the contribution of the aerosols is included. The concentration and composition of the aerosols changes with time and varies with location. Very little is known about these changes. The polarimeter, together with the sun photometer, is an instrument which can measure aerosol properties and could hence supply a database of aerosol concentration, size, and composition properties. Expensive polarimeters have been employed on spacecraft and in ground astronomical observatories and have yielded valuable information on planetary cloud and aerosol haze properties. This project is conerned with what types of information about the earth's aerosols can be obtained by using groundbased inexpensive hand held polarimeters.

ED52A-0009 1330h POSTER

Learn, how to learn

MYSORE NARAYANAN (513 785 3240; narayam@muohio.edu)

MIAMI UNIVERSITY, ENGINEERING, MOSLER HALL, 1601, PECK BOULEVARD,, HAMILTON, OH 45011 3399, United States

Ernest L. Boyer, in his 1990 book, Scholarship Reconsidered: Priorities of the Professorate cites some ground breaking studies and offers a new paradigm that identifies the need to recognize the growing conversation about teaching, scholarship and research in the Universities. The use of ACORN model suggested by Hawkins and Winter to conquer and mastering change, may offer some helpful hints for the novice professor, whose primary objective might be to teach students to learn how to learn.

Action : It is possible to effectively change things only when a teaching professor actually tries out a new idea.

Communication : Changes are successful only when the new ideas effectively communicated and implemented.

Ownership : Support for change is extremely important and is critical. Only strong commitment for accepting changes demonstrates genuine leadership.

Reflection : Feedback helps towards thoughtful evaluation of the changes implemented. Only reflection can provide a tool for continuous improvement.

Nurture : Implemented changes deliver results only when nurtured and promoted with necessary support systems, documentation and infrastructures.

Inspired by the ACORN model, the author experimented on implementing certain principles of Total Quality Management in the classroom. The author believes that observing the following twenty principles would indeed help the student learners how to learn, on their own towards achieving the goal of Lifelong Learning. The author uses an acronym : QUOTES : Quality Underscored On Teaching Excellence Strategy, to describe his methods for improving classroom teacher-learner participation.

1. Break down all barriers. 2. Create consistency of purpose with a plan. 3. Adopt the new philosophy of quality. 4. Establish high Standards. 5. Establish Targets / Goals. 6. Reduce dependence on Lectures. 7. Employ Modern Methods. 8. Control the Process. 9. Organize to reach goals. 10. Prevention vs. Correction. 11. Periodic Improvements. 12. Maintain Momentum. 13. Feedback : Communication. 14. Fact Based Decisions. 15. Exploit Opportunities. 16. Mobilization of Expertise. 17. Drive out Fear. 18. Recognition / Keep Score. 19. Identify Accomplishments. 20. Customer Focus / Results.

In conclusion, the author believes that the ACORN model and the QUOTES model may offer some guidelines that would help and enable the instructor to motivate learners to learn on their own.

References

Boyer, Ernest L. (1990). Scholarship reconsidered: Priorities of the Professorate. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.

Hawkins, P., & Winter, J. (1997). Mastering change: Learning the lessons of the enterprise in higher education initiative. London: Department for Education and Employment.

Narayanan, Mysore (2002). Total Quality Management (TQM) and the Teaching Professor. Oxford, Ohio. : Mimi University : 22nd Annual Lilly Conference on College Teaching.

ED52A-0010 1330h POSTER

College and University Earth System Science Education for the 21st Century (ESSE 21)

Donald R. Johnson[1] (donj@ssec.wisc.edu)

Martin Ruzek[2] (ruzek@usra.edu)

Diane Schweizer[3] (diane@icess.ucsb.edu)

[1]Universities Space Research Association, SSEC 1225 West Dayton St, Madison, WI 53706, United States

[2]Universities Space Research Association, 8426 Polifka Rd, Whitelaw, WI 54247, United States

[3]University of California Santa Barbara, ICESS, Santa Barbara, CA 93106, United States

The NASA/USRA Cooperative University-based Program in Earth System Science Education (ESSE), initiated over a decade ago through NASA support, has led in the creation of a nationwide collaborative effort to bring Earth system science into the undergraduate classroom. Forty-five ESSE institutions now offer over 120 Earth system courses each year, reaching thousands of students annually with interdisciplinary content. Through the course offerings by faculty from different disciplines and the organizational infrastructure of colleges and universities emphasizing cross disciplinary curricula, programs, degrees and departments, the ESSE Program has led in systemic change in the offering of a holistic view of Earth system science in the classroom. Building on this successful experience and collaborative infrastructure within and among colleges, universities and NASA partners, an expanded program called ESSE 21 is being supported by NASA to extend the legacy established during the last decade. Through its expanded focus including partnerships with under represented colleges and universities, the Program seeks to further develop broadly based educational resources, including shared courses, electronic learning materials and degree programs that will extend Earth system science concepts in both undergraduate and graduate classrooms and laboratories. These resources emphasizing fundamentals of Earth system science advance the nations broader agenda for improving science, technology, engineering and mathematics competency. Overall the thrust within the classrooms of colleges and universities is critical to extending and solidifying courses of study in Earth system and global change science.

ESSE 21 solicits proposals from undergraduate institutions to create or adopt undergraduate and graduate level Earth system science content in courses, curricula and degree programs. The goal for all is to effect systemic change through developing Earth system science learning materials, courses, curricula, minors or degree tracks, and programs or departments that are self-sustaining in the coming decades. Interdisciplinary college and university teams are competitively selected through a peer-reviewed Call for Participation. ESSE 21 offers an infrastructure for an interactive community of educators and researchers including under represented participants that develops interdisciplinary Earth system science content utilizing NASA resources involving global change data, models, visualizations and electronic media and networks. The Program provides for evaluation and assessment guides to help assure the pedagogical effectiveness of materials developed. The ultimate aim of ESSE 21 is to expand and accelerate the nations realization of sound, scientific interdisciplinary educational resources for informed learning and decision-making by all from the perspective of sustainability of the Earth as a system.

URL: http://esse21.usra.edu

ED52A-0011 1330h POSTER

From Scientist to Educator: Oceanography in the Formal and Informal Classroom

Annie H. Richardson[1] (818-393-1064; Annie.H.Richardson@jpl.nasa.gov)

Mona Jasnow[1] (818-393-5920; Mona.Jasnow@jpl.nasa.gov)

Margaret S. Srinivasan[1] (818-393-3974; mss@jpl.nasa.gov)

Vinca Rosmorduc[2] (33-0-561-394-856; vrosmorduc@cls.fr)

Frederique Blanc[2] (33-0-561-394-768; fblanc@cls.fr)

[1]NASA/Jet Propulsion Laboratory , Mail Stop 264-355 4800 Oak Grove Drive, Pasadena, CA 91109-8099, United States

[2]Centre National d'Etudes Spatiales, CLS, Direction Oceanographie Spatiale, Dept. Produits et Services, 8-10 rue Hermes , Ramonville St. Agne 31526, France

The TOPEX/Poseidon and Jason-1 ocean altimeter missions offer the educator in the middle school or informal education venue a unique opportunity for reinforcing ocean science studies. Two new educational posters from the United States NASA/Jet Propulsion Laboratory and Frances Centre National dEtudes Spatiales provide teachers and students a tool to examine topics such as the dynamics of ocean circulation, ocean research, and the oceans role in climate.

Voyage on the High Seas; A Jason-1 Oceanic Adventure is a poster/board game that offers learning opportunities through a non-textbook activity designed to stimulate interest in ocean science in a fun and instructive environment. The object of the game is to be the first to sail your research vessel from the Mediterranean Sea to Seattle, Washington while gaining Discovery Points. The starting point in the Mediterranean is where the mythological adventurers Jason and the Argonauts set out on their epic voyage to find the golden fleece. Discovery and Quiz Cards are used to challenge players to gain knowledge and points by correctly answering questions using clues from the board. Teachers can directly photocopy additional activities from the reverse side of the board game for use in a middle school Earth science curriculum. The game is also a stand-alone poster that is an engaging world map depicting the worlds oceans and continents, major ocean currents, and other important geographic features.

A second poster has been developed as a joint JPL/CNES effort. Oceans Music: Climates Dance highlights the ocean/climate link and provides educational activities that can be used directly in the classroom. The eye-catching poster is appropriate for display in both the formal and informal education setting. In both venues it should stimulate conversation about the ocean and provide a point of entry into inquiry-based learning about the connections between ocean circulation and global climate. It also seeks to emphasize the role of the ocean in sustaining life on Earth. Activities on the back of the poster can be used as supplemental material in a middle school Earth science curriculum, and are suitable for individual instruction and for classroom or group exercises. This poster will be published in both English and French.

Educational research indicates that an inquiry-based method of student engagement is an appropriate and effective teaching tool. These posters offer a fun and instructive environment to promote student interest in Earth Science in general and particularly in oceanography.

ED52A-0012 1330h POSTER

Project CUES: A New Middle-School Earth System Science Curriculum Being Developed by the American Geological Institute

Matthew C. Smith[1] (703-379-2480; mcs@agiweb.org); Michael J. Smith[1]; Norman Lederman[2]; John B. Southard[3]; Elizabeth A. Rogers[1]; Caitlin N. Callahan[1]

[1]American Geological Institute, 4220 King St., Alexandria, VA 22302, United States

[2]Dept. of Mathematics and Science Education, Illinois Institute of Technology, 10 West 32nd St, Chicago, IL 60616, United States

[3]Dept. of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139, United States

Project CUES is a middle-school earth systems science curriculum project under development by the American Geological Institute (AGI) and funded by the National Science Foundation (ESI-0095938). CUES features a student-centered, inquiry pedagogy and approaches earth science from a systems perspective. CUES will use the expanded learning cycle approach of Trowbridge and Bybee (1996), known as the 5E model (engage-explore-explain-elaborate-evaluate). Unlike AGIs Investigating Earth Systems (IES) curriculum modules, CUES will include a single hard-bound textbook, and will take one school-year to complete. The textbook includes a prologue that addresses systems concepts and four main units: Geosphere, Hydrosphere, Atmosphere, and Biosphere. Each eight-week unit takes students through a progression from guided inquiry to open-ended, student-driven inquiry. During first 4 to 5 weeks of each unit, students explore important earth science phenomena and concepts through scripted investigations and narrative reading passages written by scientists as inquiry narratives. The narratives address the development of scientific ideas and relay the personal experiences of a scientist during their scientific exploration. Aspects of the nature of science will be explicitly addressed in investigations and inquiry narratives. After the guided inquiry, students will develop a research proposal and conduct their own inquiry into local or regional scientific problems. Each unit culminates with a science conference at which students present their research. CUES will be the first NSF-funded, comprehensive earth systems textbook for middle school that is based on national standards. CUES will be pilot tested in 12 classrooms in January 2003, with a national field test of the program in 50 classrooms during the 2003-2004 school year.

URL: http://www.agiweb.org/education/cues/

ED52A-0013 1330h POSTER

"This Dynamic Planet" Map: Feedback Solicited on 3rd Edition in Progress

Tom Simkin[1] (1-202-357-2786; simkin@nmnh.si.edu); Robert I. Tilling[2] (1-650-329-5234; rtilling@usgs.gov); Peter R. Vogt[3] (1-202-404-1102; vogt@qur.nrl.navy.gov); Stephen Kirby[2] (1-650-329-4847; skirby@usgs.gov); Paul Kimberly[1] (1-202-2615; kimberly@volcano.si.edu); David B. Stewart[4] (1-703-648-6945; dbstewart@usgs.gov)

[1]1. Smithsonian Institution, 1. Department of Mineral Sciences, Washington, DC 20560-0119, United States

[2]U.S. Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025, United States

[3]Naval Research Laboratory, Geosciences Division, Washington, DC 20375-5320, United States

[4]U.S. Geological Survey, National Center 959, Reston, VA 90192, United States

Cartography by Will R. Stettner (USGS-Reston) and Antonio Villaseñor (University of Utrecht)

Earlier editions of this 1:30 million Mercator world map of volcanoes, earthquakes, impact craters, and plate tectonics were published in 1989 and 1994. About 100,000 copies have since found their way to classrooms and research labs. Today's vastly improved data sets, particularly land and seafloor topography, allow improvements in the third edition, to be published in 2003. All elements of the new double-sided edition will be digital, and we are also working towards an interactive version on the web. As before, the front of the map will include a perspective cross-section illustrating plate tectonic processes, and an interpretive inset map of both sharp and diffuse plate boundaries and hotspots. Additions to earlier editions include polar caps on the front (making it a complete world map, for the first time), and a variety of supplementary resources printed on the back. The map?s back will feature a 1:150 million geologic map of the world, plus timelines and a sequence of paleogeographic maps, giving temporal context to the "snapshot" of today's dynamics shown on the main map. It will also display progressively higher resolution graphics of selected examples of convergent, transform, and divergent plate boundaries, hotspot volcanoes, and impact craters. These features will, we hope, increase understanding of the main map, both for classroom work and individual study.

To make the map as accurate and useful as possible, we solicit feedback from AGU meeting participants. Our poster will be a current draft of the 1x1.5 m map, plus a laptop version of the ArcView GIS version for zooming in on areas of particular interest. Please stop by and help us refine areas that you know better than we do. The collective knowledge of AGU participants offers the potential of further improvement of the new map, and we ask for your help in that effort.

ED52B MCC: Hall D Friday 1330h

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

Presiding: **C E Walker,** National Optical Astronomy Observatory**; S Q Foster,** University Corporation for Atmospheric Research

ED52B-0014 1330h POSTER

A Space Physicists Adventure in K-5 Space Science Education

Mark B Moldwin (310-825-5556; mmoldwin@igpp.ucla.edu)

UCLA, Earth and Space Sciences, IGPP, Los Angeles, CA 90095-1567, United States

A UCLA partnership with El Marino Language Elementary School in Culver City CA has provided the opportunity to work with primary grade teachers and students. Our activities have been based around NASA OSS's Sun-Earth Day and Space Day. This years project is centered around Lockheed-Martins Student Signatures in Space program and includes a 2-hour after-school Professional Development Workshop for K-5 teachers, solar viewing, and an in class fun with magnets activity. The presentation will include a discussion of what NASA K-3 activities have been used and the motivation of the author to form a University-Elementary School partnership.

ED52B-0015 1330h POSTER

High "IMPACT" STEREO EPO: Exploiting Opportunities for High Visibility Activities On a Shoestring

Nahide Craig[1] (510-643-7273; ncraig@ssl.berkeley.edu)

Janet G Luhmann[1] (510-643-2545; gjluhmann@ssl.berkeley.edu)

Indrannel Sircar[1] (510-643-7273; sircar@ssl.berkeley.edu)

Noah Wittman[2] (415-353-0459; noahw@exploratorium.edu)

[1]UC Berkeley-Space Sciences Laboratory, Centennial Drive @Grizzly Peak, Berkeley, CA 94720-7450, United States

[2]Exploratorium, 3601 Lyon Street, SanFranciso, CA 94123-1099, United States

Our dynamic Sun offers exciting opportunities to share research discoveries of NASAs Sun Earth Connection Missions for the pre-college education and public outreach communities. NASA's STEREO/IMPACT Mission E/PO seeks to offer national programs for broad audiences that highlight the Missions solar and geo-space activities. The partnership between the Mission scientist and the Mission E/PO is essential to fully reap the fruits of this rich education and public outreach effort. We will share two events, a high visibility, successful Eclipse 2001 participation and a new project an exciting prototype program converting the science results of solar energetic particle data to sound, and ultimately to create a composition inspired by these sounds and related solar images by a musician. Data from an earlier twin-spacecraft Mission, Helios1/2 (courtesy of D. Reames, GSFC and the Helios mission investigators) are used as a testbed for creating the stereo sounds from the future STEREO data. We hope these efforts will lead to a recording by an ensemble as well. We will discuss lessons learned and future opportunities for scientist participation.

ED52B-0016 1330h POSTER

Bringing Hands-on Activities and Real Scientists to Students: Bishop Museums X-treme Science Exhibit, Holoholo Science Program, and Planned Science Learning Center

Denise J. Hills[1] (808-848-4162; dhills@bishopmuseum.org)

Kay Fullerton[1] (fullertn@bishopmuseum.org)

Cynthia Hoddick[1] (cindy@bishopmuseum.org)

Nancy Ali[1] (nali@bishopmuseum.org)

Melissa Kim Mosher[1] (mkmosher@bishopmuseum.org)

[1]Bishop Museum, Education Department 1525 Bernice St, Honolulu, HI 96817-2704, United States

Bishop Museum developed the X-treme Science: Exploring Oceans, Volcanoes, & Outer Space museum exhibit in conjunction with NASA as part of their goal to increase educational outreach. A key element of the exhibit was the inclusion of real scientists describing what they do, and fostering the interaction between scientists and students. Highlights of the exhibit were interviews with local (Hawaii-based) scientists involved in current ocean, volcano, and space research. These interviews were based on questions that students provided, and were available during the exhibit at interactive kiosks. Lesson plans were developed by local teachers and scientists, and provided online to enhance the exhibit. However, one limitation of the museum exhibit was that not all students in the state could visit, or spend enough time with it. To serve more remote schools, and to provide for additional enrichment for those who did attend, the education department at Bishop Museum developed a traveling program with the X-treme Science exhibit as the basis. The Holoholo (Hawaiian for fun outing) Science program brings a scientist into the classroom with a hands-on scientific