in multimedia training modules, which allow them to change astronomical, atmospheric, geological and biological aspects of the Earth and our star system and to view the effects of these changes on Earth. By focusing on Earth, students draw on their prior knowledge, which helps them to connect their new knowledge to their existing schema. Cause and effect relationships of Earth provide a concrete model from which students can observe patterns and generalize abstract results to an imagined planet. From these observations, students draw conclusions about what aspects allowed Earth to remain habitable. Once students have generalized needed conditions of "what" we need for a habitable planet, they conduct further research in offline, standards-based classroom activities that also follow the inquiry model and help students to understand "why" we need these conditions. These lessons focus on standards-based concepts such as states of matter and the structure and movement of the Earth's interior. These lessons follow the inquiry structure commonly referred to as the five E's as follows: Engage: Draws on students' prior knowledge, builds on previous lesson concepts, introduces the purpose of the lesson and the scientific question which is the problem or intellectual confrontation they will explore. Explore: Students form hypotheses and conduct an exploration that will help them to collect data and evidence to answer the scientific question. Explain: Students reflect on the explore activity by recording their results and conclusions. They participate in guided discussions or activities that help to guide their understanding of the concepts. Extend/Apply: Students demonstrate their understanding of the concept and/or apply it to another situation. Evaluate: Students are evaluated on their understanding of the concept often using rubrics. After students have mastered the "whats" and "whys," they engage in multimedia mission modules that simulate "how" scientists might search for a planet and star system that meets these requirements using the inquiry process. Students are first asked to hypothesize the likelihood of finding a star system that meets these requirements. They then simulate the methods scientists might use to collect data on various stars and planets to deduce whether the star system meets the requirements for habitability or not. After collecting and analyzing this data, students are asked to draw conclusions in comparing their results to their initial hypothesis. Students apply all that they've learned to design a planet that meets the requirements for human habitability in all areas. Through this process, they learn that Earth works as a system in meeting our needs.

URL: http://astroventure.arc.nasa.gov

ED22B MCC: Level 2 Tuesday 1330h

Enhancing K-12 Earth Science Education Through Partnership II Posters *(joint with OS, PA)*

Presiding: **M J Smith,** American Geological Institute**; A E Benbow,** American Geological Institute**; R Brame,** Wright State University

ED22B-1231 1330h POSTER

Oceanographers in the Fifth Grade

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Graduate students and recent doctorates at the University of South Florida College of Marine Science and K-12 teachers in Pinellas County, Florida come together in a new GK-12 OCEANS initiative to bring science to life in the classroom. In our particular partnership, we are working with four fifth grade classes and a combined fourth and fifth grade class at Frontier Elementary School in Clearwater, Florida. Our students have made weekly weather measurements, making their own instrumentation, building a data set, evaluating time series, and coming to understand the changing nature of climate and weather over the course of the school year. Additionally, they have conducted a number of shorter-term projects, engaging in hands-on, minds-on scientific research into many different aspects of the ocean environment, individually and in groups.

ED22B-1232 1330h POSTER

Cataclysms and Catastrophes: A Case Study of Improving K-12 Science Education Through a University Partnership

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The K-12 science teacher is always seeking ways of improving and updating their curriculum by integrating the latest research into their most effective classroom activities. However, the daily demands of delivering instruction to large numbers of students coupled with the rapid advances in some fields of science can often overwhelm this effort. The NSF-sponsored Cataclysms and Catastrophes curriculum, developed by scientists from the The University of Texas at Austin Institute for Geophysics (UTIG) and Bureau of Economic Geology (BEG), middle and high school teachers, and UT graduate students (NSF GK-12 fellows) working together through the GK-12 program, is a textbook example of how universities can facilitate this quest, benefiting education at both K-12 and university levels. In 1992, "The Great K-T Extinction Debate" was developed as an activity in the Planet Earth class at the Liberal Arts and Science Academy of Austin as an interdisciplinary approach to science. Taking advantage of the media attention generated by the impact scenario for the K-T extinction, the activity consists of students participating in a simulated senate hearing on the potential causes of the K-T extinction and their implications for society today. This activity not only exposes students to the wide range of science involved in understanding mass extinctions, but also to the social, political and economic implications when this science is brought into the public arena and the corresponding use of data in decision making and disaster preparedness. While "The Great K-T Extinction Debate" was always a popular and effective activity with students, it was in desperate need of updating to keep pace with the evolving scientific debate over the cause of the K-T extinction and the growing body of impact evidence discovered over the past decade. By adding two inquiry-based learning activities that use real geophysical data collected by scientists studying the buried Chicxulub feature as a culmination to the classroom debate, we developed a curriculum module on Asteroids Impacts for the Cataclysms and Catastrophes project. This approach proved to be the ideal way to update the existing Planet Earth curriculum and to provide students with opportunities to use cutting-edge, hands-on geophysical and computer techniques to understand the most up-to-date science concerning the K-T extinction event.

URL: http://www.ig.utexas.edu/outreach/gk-12/cat-intro.htm

ED22B-1233 1330h POSTER

Devious Lies: Adventures in Freelance Science Outreach

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Observations are given from two freelance science outreach projects undertaken by the author: Tutoring at-risk secondary students and teaching astronomy to 5th-7th graders in a camp retreat environment. Two recurring thematic challenges in these experiences are considered: First the 'Misperception Problem', the institutionalized chasm between the process of doing science and K-12 science education (wherein science is often portrayed as something distant and inaccessible, while ironically children are necessarily excellent scientists). And second the 'Engagement Problem', engaging a student's attention and energy by matching teaching material and–more importantly–teaching techniques to the student's state of development. The objective of this work is twofold: To learn how to address these two challenges and to empower the students in a manner independent of the scientific content of any particular subject. An underlying hypothesis is that confidence to problem solve (a desirable life-skill) can be made more accessible through a combination of problem solving by the student and seeing how others have solved seemingly impossible problems. This hypothesis (or agenda) compels an emphasis on critical thinking and raises the dilemma of reconciling non-directed teaching with very pointed conclusions about the verity of pseudo-science and ideas prevalent about science in popular culture. An interesting pedagogical found-object in this regard is the useful 'devious lie' which can encourage a student to question the assumption that the teacher (and by extension any professed expert) has the right answers.

ED22B-1234 1330h POSTER

The Sombrero Marsh Education Program: Diverse partnerships building strong Earth System science programs

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Broad-based science education partnerships can create exemplary education programs because each partner brings their particular expertise to the table. The Sombrero Marsh Education Program provides an example of such a program where a school district, a local government agency, a non-profit organization, and an institute of higher learning developed a field-based watershed curriculum for upper elementary students at Sombrero Marsh, a recently restored rare saline marsh located in Boulder Valley. The partners' expertise, ranging from wetland ecology and restoration to pedagogy, yielded a curriculum that includes many of the characteristics that are highlighted within the National Science Education Standards, such as inquiry-based, hands-on activities where students serve as scientists and collect real data that will be used to monitor the progress of marsh restoration. Once established, these diverse partnerships can attract further funding and expand their programs from the local to the national level, thus providing a successful model with a widespread impact. The Sombrero Marsh Program will soon be making this transition because the Cooperative Institute for Research in Environmental Science (CIRES), along with 4 other departments of the University of Colorado, was awarded a NSF GK-12 Grant to expand the marsh program to the secondary science level. Using the initial Sombrero Marsh Program as a guide, eight GK-12 Fellows from the departments of Chemistry and Biochemistry, Geological Sciences, Environmental and Evolutionary Biology, and Astrophysical and Planetary Sciences will develop a secondary science level program at Sombrero Marsh, which initially will be delivered to schools with a significant population of students from under-represented groups. Several dimensions of the marsh program, such as community-based research and ecological sterwardship, can serve as a national model for similar science education programs that aim to promote Earth System science.

ED22B-1235 1330h POSTER

The PISCES Project: How Teacher-Scientist Partners can Enhance Elementary Science Instruction

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The PISCES Project (Partnerships Involving the Scientific Community in Elementary Schools www.sdsa.org/pisces) is an innovative program that brings high quality standards-based elementary science curriculum and hands-on laboratory materials into San Diego County's classrooms. The project is funded by the NSF Graduate Teaching Fellows in K-12 Education (GK-12) program. The project was designed and is administered through cooperation among faculty at San Diego State University and the Science Department of the San Diego County Office of Education. Undergraduate and graduate students enrolled in science programs in San Diego area universities including San Diego State University, California State University San Marcos, and University of California San Diego partner with elementary school teachers. Through this

partnership, the scientist brings scientific expertise to the classroom while the teacher delivers the lesson using current pedagogic methods. This is accomplished during a 3 month partnership in which the scientist joins the teacher in the classroom a few days each week to complete professional kit-based curriculum such as that available from FOSS (Full Option Science System) and STC (Science and Technology for Children). The teachers remain in the program for two years during which they have continuous access to the kit-based curriculum as well as two to three partnership cycles. Teachers receive assistance outside of the classroom as well attending professional development institutes three times a year to establish and maintain effective science teaching methods. The San Diego Science Alliance and other community and industry supporters provide the additionalfunding necessary to provide this teacher professional development Currenty, PISCES is present in over 40 schools and is able to provide partnerships to over 100 classrooms each year. In addition to the work done in San Diego, the project has expanded to Barrow, Alaska with plans to expand to La Paz, Mexico where there are SDSU climate research stations. San Diego and Alaska scientists travel to Barrow twice a year to participate in an intense, month-long science instruction partnership. PISCES collects a variety of data including student work, science attitude surveys, interviews with students and teachers, video, as well as science content knowledge. The students find themselves enjoying science and are deeply impacted by the presence of an actual scientist in their classroom. As PISCES enters its fifth year, it is evident that the combination of continuous support inside and outside of the classroom is successful in developing teacher engagement in science instruction.

URL: http://www.sdsa.org/pisces

ED22B-1236 1330h POSTER

Integrating Marine Science Into Elementary School Education

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Oceanography has become the theme for science in a fourth grade classroom at Forest Lakes Elementary (FLE) in Oldsmar, Florida. As participants in a new GK-12OCEANS program, we have incorporated marine science ideas into the state standards in an attempt to create an interdisciplinary understanding of the world around us. The National Science Foundation (NSF) funded GK-12 initiative allows graduate students from the College of Marine Science, University of South Florida to collaborate with K-12 teachers in Pinellas County, Florida. Our goal at FLE is to engage students in science and the scientific processes by tapping into the natural resource that surrounds them, the ocean. To create coherency among the state standards, students focus on three primary questions that address why the oceans exist, their composition, and why we study them. Subdisciplines created under each category allow us to cover topics such as life processes, ecosystem diversity, and energy. An inquiry-based, hands-on, minds-on approach is an important component of our science learning process.

ED22B-1237 1330h POSTER

The No Child Left Behind Act: Clarifying the Potential Role of Scientists

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The No Child Left Behind Act (NCLB) of 2001 seeks to redefine the role the federal government plays in K-12 education. The four basic principles behind the NCLB's sweeping reform are: stronger accountability for results, increased flexibility and local control, expanded options for parents, and an emphasis on teaching methods that have been proven to work. Beginning first by focusing on reading and mathematics and then following quickly in science, the full extent to which this act will impact schools is unclear. One clause in this act suggests that math and science achievement will be improved by having school districts forge partnerships with math and science departments at institutions of higher education, including research universities. However, it is also unclear how scientists who are committed to K-12 teacher education should respond to the directives in NCLB. We examine the NCLB Act in depth with the goals of providing a more clear overview of the roles scientists may be expected to take if NCLB becomes the model for education reform and stimulating discussion amongst scientists and educators about how best to rapidly respond to the immediate needs of students, teachers, and schools. Work supported in part by a grant from the Arizona Board of Regents and the Arizona Regents University to the University of Arizona Conceptual Astronomy and Physics Education Research (CAPER) Team at Steward Observatory.

ED22B-1238 1330h POSTER

Students Across Borders: A Summer Earth Science Workshop for Hispanic High School Students

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Southern Arizona has a high school (HS) population that is 28% Hispanic. However this fast-growing minority group represents only 14% of undergraduate students at the University of Arizona and 11% of science and engineering majors. The Students Across Borders Program was designed to assist Hispanic HS students across borders that often separate them from higher education and careers in science. In June 2003, five person student-teacher teams from Tucson, Yuma, and northern Sonora, Mexico lived in dormitories and participated in a weeklong program based on the University of Arizona campus. Activities included: field trips featuring inquiry-based investigations of geology, water quality, and tree rings; tours of engineering and science laboratories; introduction to student support organizations such as the Society of Hispanic Professional Engineers; and counseling by Career Services and Admissions personnel. Technology training included instruction in web design, digital imaging and online communication tools. Web sites developed by the student teams were presented to participants and families at the conclusion of the on-campus program. Web site development is continuing during the academic year to foster continuing communication between the student teams and presentation of results of follow-on projects assisted by graduate and undergraduate CATTS fellows and university faculty.

URL: http://studentsacrossborders.arizona.edu

ED22B-1239 1330h POSTER

Scientist/educator Collaboration for the Professional Development of High School Science Teachers

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Concern over the levels of underachievement in mathematics and science in American schools has given rise to a number of reform initiatives. The most notable of these has been the development of national standards for the teaching of mathematics and science by the National Council of Teachers of Mathematics and the National Research Council, respectively. However, an indispensable element of any reform effort is teacher quality. This paper reports on an innovative approach to the design of courses to enhance teacher quality in mathematics and science. In 2002, Morgan State University, the designated urban university for the state of Maryland, successfully proposed to the Maryland Higher Education Commission, the establishment of Master of Science degrees in mathematics education and science education. The courses developed by the approach described in this paper are designed for inclusion in these programs. There is growing recognition in the teacher education literature that effective teaching requires that teachers have knowledge in at least three distinct domains: disciplinary or content knowledge, general pedagogical knowledge and pedagogical content knowledge. The last of these is a fairly recently proposed construct and it is this aspect of teacher education that forms the conceptual basis of the innovation that is described in this paper. The approach involved eight scientists, four mathematics and science educators, and three high school mathematics and science teachers, in two weeks of intense collaboration to design courses that combine content and pedagogy. The content of the courses was closely aligned to the high school mathematics and science curricula, and the courses were designed to emphasize: Depth of content knowledge; Authentic scientific activity; Modeling of appropriate pedagogy; Promotion of children's mathematics and science concept development; and Team-teaching by mathematicians or scientists and educators. Such courses represent a departure from traditional teacher preparation programs, which typically offer science and mathematics content courses in departments of mathematics and science, and courses in pedagogy in schools or departments of education. The authors contend that the traditional model does not foster the development of pedagogical content knowledge. By combining content and pedagogy, these courses facilitate the transformation of mathematics and science content knowledge for effective teaching and hence, enhanced student learning. The interaction of scientists, mathematicians and schoolteachers in a two-week course-writing workshop raised a number of issues that are pertinent to the nature of science teaching. The paper discusses these issues, and describes the approach to science and mathematics teacher preparation which is exemplified by the courses.

ED22B-1240 1330h POSTER

Exposing Middle School Students to Remote Sensing in Alaska

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The need for attracting young minds to scientific research at an early stage is already recognized. Efforts are underway by major organizations to inspire the next generation of scientists. To be effective, there is a need to exploit the potential of the World Wide Web and bring it to a status that printed media have already reached. We find series of theme oriented books for children but websites with such stories are few and scattered. NASA's efforts in generating remote sensing based web stories such as the 'Adventures of Amelia the Pigeon' and 'Echo the Bat' are very good examples and starting points for generating more theme based material for children. 'Alaska: A Bird's Eye View' is a web-based story, specifically designed for grade 5-8 students. The story that is told by a Canada Goose exposes children to the truths of the remote State of Alaska and to the potential of satellite remote sensing. Examples on use remote sensing for monitoring volcanoes and sea ice edge dynamics are related to children in simple and effective ways. The topic of global climate change and its effect on marine animals has also been introduced to children.

URL: http://www.uaf.edu/asgp/k12

ED22B-1241 1330h POSTER

Geeksta Rap: An Example of the Utilization of Elements of Popular Culture in Science Education and Outreach

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Science education and outreach efforts must compete for the attention of students in an environment filled with many distractions. Many of the most compelling of these distractions arise from popular culture. Rather than bemoaning this situation, we propose that we make use of some of those elements of popular culture which garner the most attention. In particular, we propose that we utilize the popularity of current hip-hop and rap music in science education and outreach efforts. To that end, we present some examples of what we call 'geeksta rap' and discuss some of the considerations relevant for its preparation. We also discuss various uses of 'geeksta rap' in science education and outreach.