Education and Human Resources (ED)

ED53A
Poster Hall (Moscone South)
Friday
1340

Teacher Professional Development Programs Promoting Authentic Scientific Research in the Classroom III Posters

Presiding:  S M Pompea, Natl Optical Astronomy Obs, Tucson; G Scowcroft, University of Rhode Island, Narragansett; C E Walker, Education & Public Outreach, National Optical Astronomy Observatory, Tucson

ED53A-0509 Poster
Students As Researchers In An Inquiry Based Classroom

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A teacher who participated in the National Science Foundation supported ARMADA Project through the University of Rhode Island Office of Marine Programs will share a series of lessons based on her experiences working with marine researchers. All of the activities are hands-on, inquiry based for use in elementary and secondary classrooms. The primary objective of these lessons is to give students a better understanding of what real scientist do and why. This enables students to make a real world connection with the scientific community. The emphasis on environmental monitoring will help develop an understanding of the positive and negative consequences of human action on the Earth's oceans. It will enhance the student's observation skills and increase their ability to record and analyze data.


ED53A-0510 Poster
The ARMADA Project: Bringing Oceanography and the Arctic to the Midwest

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In the fall of 2009, I spent 6 weeks aboard the Coast Guard Icebreaker Healy on a mapping expedition in the Arctic Ocean, through participation in the University of Rhode Island's ARMADA Project. Because I grew up in the Midwest, went to college here, and teach in the Chicago suburbs, I had limited first-hand experience in oceanography, as did most of my students. During my time aboard the ship, I primarily served as a member of the mapping team, collecting bathymetric and seismic data. My other science activities included aiding geologists and acoustic engineers in dredging projects and deployment of under-ice recording devices. I collected water data, sent off weather balloons, and assisted marine mammal observers. For the ARMADA Project I kept an on-line journal, which had a far-reaching impact. Students in many schools kept track of my activities and communicated with me via e-mail. Colleagues and friends shared the journal through other media, such as Facebook. Several of my entries were published in blogs belonging to NOAA and the USGS. I received a grant for renting a satellite phone, and through it was able to make "Live from the Arctic" phone calls. After introductory PowerPoints I communicated with more than 420 students in 5 schools in 3 states. When I returned, I made a series of presentations about the Arctic and my adventures to hundreds of people and was featured in an educational magazine with a circulation of more than 90,000. I also participated in an in-depth mentoring program with a new teacher to help her succeed during the first years of her career. The results: My students and I now have a direct connection to the Arctic and to the fields of oceanography, acoustic engineering, and geology. On their own initiative, students have developed individual projects exploring aspects of my research. They have attended presentations from the Extreme Ice Center and have become involved in drilling issues in the Chukchi Sea. A group of students is exploring the possibility of working with scientists from Scripps Institution of Oceanography to analyze the acoustic data. These are just some of the ways that a teacher's research experience can be effectively translated into the classroom setting.


ED53A-0511 Poster
URI's ARMADA Research Experience Leads to Inspiring Middle School Students to Become Ocean Stewards

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After spending three weeks aboard NOAA's David Starr Jordon, my classroom has come alive with ocean life. My research experience was part of URI's ARMADA project. I worked alongside scientists as they conducted “business as usual” on the CSCAPE expedition. CSCAPE’s mission was to survey the cetacean abundance in the Pacific Ocean. My leg of the voyage took us as far out as 300 nautical miles from the coast and from points between Newport, Oregon and San Francisco, California. Throughout the three weeks, I learned with the best of them how cetaceans are identified, photographed, counted, and biopsied. This 2005 research experience is still with me today in the classroom. I have created a “Bring the Sea to Me” program in which my middle school students teach elementary students about ocean life. My students also use video footage and photographs from my expedition to create wildlife documentaries shown at our annual Film Festival. My participation in CSCAPE inspired me beyond belief, and I can only hope that my enthusiasm for the ocean is inspiring
The “Adopt A Microbe” project: Web-based interactive education connected with scientific ocean drilling

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IODP Expedition 327 Shipboard Party

We launched the "Adopt a Microbe" project as part of Integrated Ocean Drilling Program (IODP) Expedition 327 in Summer 2010. This eight-week-long education and outreach effort was run by shipboard scientists and educators from the research vessel JOIDES Resolution, using a web site (https://sites.google.com/site/adoptamicrobe) to engage students of all ages in an exploration of the deep biosphere inhabiting the upper ocean crust. Participants were initially introduced to a cast of microbes (residing within an ‘Adoption Center’ on the project website) that live in the dark ocean and asked to select and virtually 'adopt' a microbe. A new educational activity was offered each week to encourage learning about microbiology, using the adopted microbe as a focal point. Activities included reading information and asking questions about the adopted microbes (with subsequent responses from shipboard scientists), writing haiku about the adopted microbes, making balloon and fabric models of the adopted microbes, answering math questions related to the study of microbes in the ocean, growing cultures of microbes, and examining the gases produced by microbes. In addition, the website featured regular text, photo and video updates about the science of the expedition using a toy microbe as narrator, as well as stories written by shipboard scientists from the perspective of deep ocean microbes accompanied by watercolor illustrations prepared by a shipboard artist. Assessment methods for evaluating the effectiveness of the Adopt a Microbe project included participant feedback via email and online surveys, website traffic monitoring, and online video viewing rates. Quantitative metrics suggest that the “Adopt A Microbe” project was successful in reaching target audiences and helping to encourage and maintain interest in topics related to IODP Expedition 327. The “Adopt A Microbe” project model can be adapted for future oceanographic expeditions to help connect the public at large to cutting-edge, exploratory research and for engaging students in active learning.

Deep ocean research meets the special education classroom

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Scientific Team of IODP Expedition 327

The scientific activities carried out on board the JOIDES Resolution during IODP Expedition 327: Juan de Fuca Hydrogeology (summer 2010) are exciting to elementary-level students and provide an excellent opportunity to use that enthusiasm to teach concepts outlined in state-mandated curricula. This is especially important for special education classrooms where individualized education plans are implemented to bring students up to these standards when regular classrooms have failed to do so. Using concepts from drilling and coring to geobiology and sedimentology, we have developed cross-curricular lesson plans for elementary special education students with learning and cognitive disabilities. All lesson plans include hands-on, visual and auditory activities and are aimed at using students' natural interest in real research to drive home simple concepts like integers, geography, pressure and descriptive writing. Because special education classrooms more often than not include children with variable abilities in all subjects, the lesson plans developed in this project can be adapted for several levels so that every child in the classroom can participate.

Trials at Sea: Successful Implementation of a Unique Two-Month Professional Development Program

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IODP Expedition 327 Participants

During the summer of 2010, Integrated Ocean Drilling Program (IODP) Expedition 327 conducted coring and observatory installations on the Juan de Fuca Plate to characterize the hydrogeology of ridge-flank ocean crust. Due to the nature of the expedition, a smaller science party than usual was needed. IODP took this opportunity to expand education, outreach, and communication (EOC) activities with a previously untested model. Up to now, the IODP U.S. Implementing Organization had sailed either individual teachers on regular (2-month long) expeditions or groups of teachers and informal educators during short (2-week long) transits (School of Rock workshops). After two shipboard (Expeditions 312 and 321T) and two shore-based (Gulf Coast Repository) programs, we have recognized that a major challenge for the Integrated Ocean Drilling Program is retaining participants and providing meaningful follow-up for schools. We have identified that a successful model for exploring the deep ocean is a group of educators who are a complementary resource for IODP and the participating educators. A unique opportunity to sail a group of educators is a beneficial model for IODP and the participants. What has been unavoidable is that these workshops took place outside regular expedition activities. Expedition 327 provided a unique opportunity to sail a diverse group of educators on a regular expedition with a full range of scientific activities. The group included individuals with a wide variety of skills and backgrounds. US participants included a late-career high school physics teacher, a visualization graduate student, an undergraduate engineering student from an historically black university, and an artist. French participants included two middle and high school earth and life science teachers. This diversity made the group more dynamic but it also posed a challenge. Numerous scientific and technical staff also participated in EOC activity design and leadership, including development of dedicated web sites and blogs. After a seminar on constructivist and inquiry-based methods, we spent the first few weeks investigating earth science concepts so EOC participants could gain a basic understanding of the regional geology and the scientific objectives of the expedition. Close to the beginning of the cruise, projects that had been outlined in general terms were clarified and strategies were developed for completing them. Individuals were able to work on projects that benefited their future goals, were beneficial to the ocean drilling community, and relied on each person’s special set of skills to carry out. Projects ranged from earth science classroom activities to robotics, computer animation, and fine arts. The outreach group also facilitated interactive videoconferences around the world, two websites, Facebook, YouTube and audio recordings for COSEE NOW’s Ocean Gazing podcasts. The scientists benefited from their students to become stewards of our oceans.
interactions with the group by experiencing and contributing to alternative teaching methods. Although more challenging in some ways, we found the outcome justified the effort and resources that made this endeavor possible. We encourage funding agencies in general and IODP in particular to continue supporting education and outreach activities of this nature.

http://joidesresolution.org/node/1154

ED53A-0515 Poster

A Virtual ANDRILLian Experience for Your Classroom

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This session takes participants on a virtual drilling expedition to Antarctica by sharing activities developed through a polar-based curriculum. The curriculum, designed for middle and high school, is subdivided into three phases: Traveling to the Ice Shelf; Extracting the Core; and Analyzing the Core. The curriculum incorporates resources developed through ANDRILL’s Education/Outreach Program and Flexhibit materials, “NOAA At the Poles”, and other IPY resources. Each phase of the curriculum will be explored during this session. National Science Standards addressed in this session include: 5-8.1, 5-8.3, 5-8.4, 5-8.5, 5-8.6, and 5-8.7. Climate Literacy Principles addressed in this session include: 2, 3, 4, and 5.

ED53A-0516 Poster

NSF RET in Southern Africa: community and research experiences in soil science

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Collaborative research on belowground carbon storage in the Kalahari Desert has provided opportunities for international research experience for US middle and high school teachers, funded by the National Science Foundation Research Experience for Teachers (RET) Program. This presentation will highlight the field research experiences, international high school visit, relationships fostered with Botswana high school teachers, and new soil science curricula developed by three US environmental science teachers. New lesson plans and activities on carbon sequestration, fine and coarse root mapping, and soil organic carbon cycling and other learning tools have been incorporated into the existing Underground Safari webpage (instaar.colorado.edu/undergroundsafari) (Figure 1). An interactive blog, undergroundsafari.edublogs.org, has been developed to allow dynamic discourse between students, teachers and researchers on this project. Lessons learned from classroom trials of curriculum and use of other RET experience-motivated activities in the classroom will be discussed.
ED53A-0517 Poster

Making Accurate Topographic Maps of the Schoolyard Using Ideas and Techniques Learned and Adapted from Multi-beam Sonar Mapping of the Arctic Ocean

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Having participated in a University of Rhode Island Project Armada expedition to join the University of New Hampshire Center for Coastal and Oceanographic Studies in making multi-beam sonar contour maps of the Arctic Ocean floor, I was able to bring the principles learned from this trip to my earth science high school students and create a project in our “mapping the earth” unit. Students learn basic surveying techniques and create authentic, accurately detailed topographic maps of the schoolyard. Models of their maps are then constructed of either Styrofoam or wood which enables them to make the transition from a 2-dimensional map to a 3-dimensional representation. Even though our maps are created using sticks, line levels, compasses and GPS, the scientific concepts of using location and elevation data to draw contour lines are identical to those used in underwater mapping. Once the students understand the science in mapping and creating contour maps to scale on graph paper by hand, they are able to easily relate this knowledge to what I was doing onboard ship using multi-beam sonar and computer mapping programs. We would like to share with you the lab and techniques that we have developed to make this activity possible with minimal materials and simple technology. As a background extension, it is also possible to replicate sonar measurements using an aquarium, food coloring, and a surface grid to map the topography of a teacher created landscape on the aquarium bottom.
Earth Science students using simple tools to accurately map the topography of the school grounds

**ED53A-0518 Poster**

The Examining Your Environment through the Power of Data Project (EYE-POD) Project at NAU: Professional Development for Secondary Education Teachers Using Earth Sciences and GIS

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The EYE-POD project at Northern Arizona University is an NSF-ITEST-funded professional development program for secondary science (SS) and career technical education (CTE) teachers. The program recruited SS-CTE teacher pairs from Arizona and the surrounding region to participate in two-week workshops during Summer, 2010, and an advanced workshop in Summer, 2011. The workshops are led by a team with distinct expertise in science content, professional development and pedagogy, GIS, and project evaluation. Learning modules and a workshop agenda are developed using the Legacy Cycle of learning. Rather than compartmentalize pedagogical, content, and GIS learning activities, they have been combined throughout the workshop timeline. Early activities focus on learning of climate and weather processes through GIS modules provided by ESRI—"Mapping our World" and "Analyzing our World". Participants learn the technical aspects of GIS software while investigating real phenomena. The science/GIS learning activities are augmented by laboratory demonstrations and field data collection using Labquest handheld field measurement systems with a variety of probes. At the end of the first week teacher-participants presented the solution to a problem, using GIS-based climate and weather data, involving travel to various locations on Earth. The second week focused on classroom, lab, and field activities devoted to recommendations to the City of Flagstaff for development in the Rio de Flag floodplain. Teacher-participant groups presented solutions making claims and recommendations supported by evidence from georeferenced field data and other GIS data acquired from various sources. At the close of the workshop teachers were provided with GIS software, hardware for field data collection, and several reference materials to aid in curriculum development. They have been tasked with implementing two GIS-based Earth science content modules in their schools, to one science class and one CTE class. One module must involve a field-based problem at their school site. The EYE-POD team will provide support to each school team through site visits and phone consultation. As part of the project, data on learning efficacy is being collected by an independent evaluator and analyzed by a science education faculty member (summarized in companion paper by Claesgens, et al.).

**ED53A-0519 Poster**

Starting with Teachers: Bringing GIS technology to the secondary classroom

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Inspired by Fieldwork: A Teacher Research Experience Energizes and Ignites a Group of Elementary Students

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Through involvement in authentic research experiences teachers improve their content knowledge, deepen their understanding of the research process, and rejuvenate their interest in science. These positive results of fieldwork transfer into the classroom, directly benefiting students. The ARMADA project provided me with a three week research experience aboard the Amundsen (Canadian Coast Guard science vessel) which enriched and strengthened me professionally. Guided by master and early career scientists, I took part in specific research techniques and deep scientific discourse. My immersion in ocean science was so stimulating that I was inspired to share that excitement with my students. The fascination my students showed for basic experiments and ocean related activities fueled my interest further and I began to research more deeply which led to Climate Literacy and Polar Studies as essentials in my science curriculum. Over the following years I continued to expand and refine the workshops and activities students take part in. Three years after the research experience students still love the science explorations we embark upon together. This past year a group of students became so excited about Polar Science and Climate that they authored a 36 page non fiction book for upper elementary and middle school students entitled, “Changing Poles, Changing Planet: Climate Change vs. The Earth”. Seven of the authors decided to continue their science outreach work by creating an educational video focusing on the basics of climate science and what children can do to lower carbon emissions. The book and video were distributed to educators as well as scientists at the International Polar Year Science Conference in June, 2010. In August some of these students presented their work at a Sustainability festival that was organized by M-CAN a local climate action group. Two of these students (who have left my class and started 6th grade at the middle school) recently decided to form a Climate Club and their goal is to continue to research and teach others about climate science. Their enthusiasm and desire to teach others is a result of exposure to authentic science issues in school and my research experience is what changed the way I teach science which made this possible.

Short-term data collection projects: A means to increase teacher content knowledge and bring authentic research experiences into the classroom

An aim of the NSF-ITEST funded POD project is to examine the effect that technology-integrated, problem-based learning modules have on the learning of secondary students whose teachers have participated in a curriculum implementation professional development structure. This research focuses on the professional development structure as the first step to achieving changes in student learning. The assumption is that the teachers themselves have to learn the technology before they can successfully implement it into their classrooms. Teachers attended a 2-week professional development workshop that presented pedagogy, content and GIS training. Our premise for the workshop was that modeling and practicing research-based pedagogical practice will improve participant science instruction through an immersion program focusing on real life problems. The second premise is that improving teacher technology skills and pedagogical knowledge and practice will improve student achievement in science. Professional development is necessary to help teachers learn not only how to use new technology but also how to provide meaningful instruction and activities using technology in the classroom. Therefore if our goal is to immerse the teachers in learning as the students, we need to measure if they indeed did learn. To evaluate if the teacher learned the material just as a student might, we administered a pre- and post-test to 23 teachers attending the workshops. There were 2 forms of the test, a multiple-choice test that focused on content questions in earth science, interpretation of GIS screen shots and spatial reasoning skills. The second component, the Geospatial Technology Performance Assessment, focused on the teachers’ abilities to use the GIS technology to gather data, sort and communicate information using maps, tables and keys. For the latter a grounded-theory approach was used to group teachers answers based on the responses provided. Teacher responses fell into 5 groups, scored 0-4. These scores were cumulative, meaning that for someone to earn a 3 they needed to be able to show proficiency at a 1 and 2 level. Results of the pre and posttests are in the table below. The ultimate goal of this project is to improve student understanding. At this point we have data that our teachers did develop an understanding of GIS from the professional development workshop that we hope to see implemented into the classroom.

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*The scoring rubric will be presented at the conference.

ED53A-0520 Poster

Geospatial Education: Working with the NASA Airborne Science Program

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WETMAAP (Wetland Education Through Maps and Aerial Photography), a program of CNL World, supports the NASA Strategic Goals and Objectives for Education by providing classroom teachers and formal and informal educators with professional development. WETMAAP promotes science through inquiry with the use of a building-block process, comparative analysis, and analytical observations. Through the WETMAAP workshops and website, educators receive the concepts necessary to provide students with a basic understanding of maps, aerial photography, and satellite and airborne imagery that focus on the study of wetlands and wetland change. The program targets educators, Grades 5 - 12, in earth science, environmental science, biology, geography, and mathematics, and emphasizes a comprehensive curriculum approach.

ED53A-0521 Poster

Inspired by Fieldwork: A Teacher Research Experience Energizes and Ignites a Group of Elementary Students

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Through involvement in authentic research experiences teachers improve their content knowledge, deepen their understanding of the research process, and rejuvenate their interest in science. These positive results of fieldwork transfer into the classroom, directly benefiting students. The ARMADA project provided me with a three week research experience aboard the Amundsen (Canadian Coast Guard science vessel) which enriched and strengthened me professionally. Guided by master and early career scientists, I took part in specific research techniques and deep scientific discourse. My immersion in ocean science was so stimulating that I was inspired to share that excitement with my students. The fascination my students showed for basic experiments and ocean related activities fueled my interest further and I began to research more deeply which led to Climate Literacy and Polar Studies as essentials in my science curriculum. Over the following years I continued to expand and refine the workshops and activities students take part in. Three years after the research experience students still love the science explorations we embark upon together. This past year a group of students became so excited about Polar Science and Climate that they authored a 36 page non fiction book for upper elementary and middle school students entitled, "Changing Poles, Changing Planet: Climate Change vs. The Earth". Seven of the authors decided to continue their science outreach work by creating an educational video focusing on the basics of climate science and what children can do to lower carbon emissions. The book and video were distributed to educators as well as scientists at the International Polar Year Science Conference in June, 2010. In August some of these students presented their work at a Sustainability festival that was organized by M-CAN a local climate action group. Two of these students (who have left my class and started 6th grade at the middle school) recently decided to form a Climate Club and their goal is to continue to research and teach others about climate science. Their enthusiasm and desire to teach others is a result of exposure to authentic science issues in school and my research experience is what changed the way I teach science which made this possible.
Short-term field research projects were embedded into a two-week, Mathematics and Science Partnership-funded, teacher institute devoted to increasing content knowledge about the physical basis of climate change. Teams of four teachers were encouraged to ask any research question related to weather or climate, and create a data collection method that they thought might help answer their question. They were provided with a range of measurement devices, from simple immersible thermometers to light sensors, probeware, and carbon dioxide concentration sensors. Teams were expected to design data collection sites in a middle-school setting, present site designs to their peers, collect data, present initial results, and participate in peer-review about site design and data collected. Teachers were encouraged to generate research questions that could be replicated with their students at their schools. Design complexity ranged widely with some teachers deliberately choosing to model sites their students might design and others making full use of more sophisticated technology. On the third day of the institute, each group presented their research question and setup for data collection in poster format. Large gaps in understanding about testable questions and effective data collection methods were apparent. Instead of addressing errors as groups presented, facilitators encouraged participants to explore each groups’ presentation and make comments using post-it notes. Participants were then encouraged to respond to the comments and consider modifying their questions, site designs, or data collection methods. Teams gathered data up to three times daily and were fully responsible for choosing means of data organization; by the second week most were using and becoming familiar with Microsoft Excel. Final presentations were in Microsoft PowerPoint. Teams were expected to graphically report data, present possible interpretations, and discuss any problems related to their initial questions or methods. All teams reported problems with their work and identified improvements for future research. Teachers reported that the field component was very helpful to their understanding of the process of science and to deepening their content knowledge about climate change research. Additionally they reported that they were much more likely to include short-term research projects in their own classrooms as a result of this experience. Short-term data collection experiences such as these can serve to: - Encourage teachers to provide students with the opportunity to develop their own questions, and design methods to answer those questions; - Expose teachers to common pitfalls in data collection methods so that teachers can later guide students as students encounter similar problems; - Familiarize teachers with widely available technology used to record and present data; - Refine teacher understanding of research and improve likelihood of success on longer research projects; - Enable teachers to look at data sets more critically and in more depth; - Better understand how to construct, read, and interpret data tables and graphs; and - Increase depth of understanding of science content.

ED53A-0523 Poster

Monitoring Anthropogenic Carbon, A Classroom Research Project
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Over the past three years high school students have participated in an authentic inquiry based research project to explore the carbon cycle, including the influence of fossil fuel CO2 emissions in northern Central California. This collaborative venture is multi-disciplinary and has included students from Environmental Systems, Chemistry, Physics and Biology. Students were engaged to collect leaves from wild mustard (Brissica spp), a common annual easily identified by the students, which grows during the winter and early spring in Northern California. During photosynthesis plants fix carbon from the atmosphere and the leaves can be used as a novel means to integrate atmospheric constituents including isotopes of carbon. Our focus has been using the lack of radiocarbon in fossil fuel carbon as a negative tracer. One of the primary goals of this research project has been to articulate the real world application of science in the community. The students calculate the local ‘loading’ of fossil fuel CO2 relative to clean air (Mauna Loa, HI). In 2011, we will be scaling the project to include three additional schools in California. The concept of this project is quite simple and could be exported nationally providing a unique inquiry based project that students can participate in.

ED53A-0524 Poster

Preparing K-8 Teachers to Conduct Inquiry Oriented Science Education
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The need for STEM professional development for K-8 teachers is well documented. Such professional development promises broad impact, but it must have a positive effect on teachers’ knowledge and skills: 1) a focus on content knowledge, 2) opportunities for active learning, and 3) coherence with other activities. However, sustained impact is only achieved through intensive professional development. In response to the need for science education courses for K-8 teachers, for the past three years, the School of Education and the Department of Physics have collaborated to offer K-8 teachers science content courses of extended duration (75 contact hours) that emphasize inquiry based learning and investigation. The School of Education graduate courses have consisted of five three-hour meetings during the months of May and June, and a two week intensive period in July when the participants come for six hours per day. The alignment of these courses with inquiry teaching was confirmed using the Reformed Teaching Observation Protocol (RTOP). Courses offered in this format have been: --Immersion in Green Energy (IGE) -alternative sources of energy and how electricity is generated (75 teachers over the last 3 years), --Immersion in Global Energy Distribution (IGED) -understanding global climate as an outcome of insolation, convection, and radiation (27 teachers over the last 2 years) The Immersion courses cover a spectrum for inquiry learning that begins with introduction to equipment and experiments through guided discovery and culminates with students taking responsibility for defining and completing their own investigative projects. As a specific example, we consider here the IGED course. For IGED, the first five sessions are devoted to content and learning to use experimental equipment such as digital data collection probes to measure temperature, CO2 and salinity. Content addressed during these sessions include the differentiation between conduction, convection, and radiation for thermal transport, specific heat, latent heat, thermal expansion, the nature of light, albedo, and properties of Earth’s orbit that contribute to Milankovitch cycles During the immersion session (9 to 4 for 10 days), participants operated in teams of two or three and selected their own investigations. For these investigations, the teams designed an experiment, and then conducted it. Project examples include: -Modeling an Urban Environment -The Effects of Abrupt Introduction of
Carbon Dioxide -Impact of Greenhouse Gases -Mini-Ecosystems: City, Ocean Water, Sand, Rain Forest, Glacier Throughout the course, it is emphasized to the participants that the material that they are learning is meant for them as adults learners rather than as material to be used directly in their classroom. This is intended to liberate them from their role as teachers and to encourage them to think about the questions they have about what they are learning. Evaluation data was collected on content gains, understanding the nature of science, self assessment of their own teaching effectiveness, and changes in teachers pedagogical approach, using pre/post tests, surveys, interviews and group discussions.

ED53A-0525 Poster

Master of Science Teaching: Encouraging Teachers and their Students in Research

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The Master of Science Teaching program is designed to encourage more content knowledge among teachers. Thirty credit hours are required, chosen from 12 hours of Earth science courses, 12 hours of space science courses, a chemistry course, a math course, and research or education credits. A thesis is not required but each teacher must have a special project (either research or curriculum). A number of students chose their project using ground penetrating radar to look for buried graves in an African-American cemetery. Others became Heliospheric Ambassadors, Messenger Ambassadors, or PolarTrec teachers. Nineteen teachers have graduated as of 2010 with six presently in the program. A survey of the participants has fifteen responses so far, with a good mixture of responses from early in the program to present students. Many (69%) were grade 6-8 teachers when they entered the program. After earning their MST, many had increased their teaching level: (93% reported that it helped their career path, 39% have upgraded to administration or science supervision, and 53% reported receiving a better or higher level job position as a result). Only one student no longer teaches (completing a PhD in Administration). Given that 20% of the respondents are still in the program, two thirds of the alumni (8 of 12) have earned better jobs. All respondents said that they learned from both the Earth and space science courses, and all respondents (except the person no longer in the classroom) say they use the earth and space science material in the classrooms, with 80% "frequently" and 13% "sometimes". They also report that they are more likely to encourage their students to become scientists (80%), more likely to encourage their students to support NASA (93%), and think that their students are getting better scores on the state standardized tests (60%). It is certainly not easy for teachers to perform publishable research (although some have), and it is even more difficult for students to perform authentic research. However, by being exposed to science data and techniques in the program, teachers become more confident of their skills and more comfortable encouraging their students to learn more. Of the respondents, 100% recommend the program to their peers, with 80% "enthusiastically".
MST teacher tracing sunspot locations.

http://space.rice.edu/MST/

ED53A-0526 Poster

Rescuing Middle School Astronomy

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There is a crisis in education at the middle school level (Spellings, 2006). Recent studies point to large disparities in middle school performance in schools with high minority populations. The largest disparities exist in areas of math and science. Astronomy has a universal appeal for K-12 students but is rarely taught at the middle school level. When it is taught at all it is usually taught in isolation with few references in other classes such as other sciences (e.g. physics, biology, and chemistry), math, history, geography, music, art, or English. The problem is greatest in our most challenged school districts. With scores in reading and math below national averages in these schools and with most state achievement tests ignoring subjects like astronomy, there is little room in the school day to teach about the world outside our atmosphere. Add to this the exceedingly minimal training and education in astronomy that most middle school teachers have and it is a rare school that includes any astronomy teaching at all. In this presentation, we show how to develop and offer an astronomy education training program for middle school teachers encompassing a wide range of educational disciplines that are frequently taught at the middle school level. The prototype for this program was developed and launched in two of the most challenged and diverse school systems in the country; D.C. Public Schools, and Montgomery County (MD) Public Schools.

ED53A-0527 Poster
GAVRT and Radio Jove: Partners in K-12 Science Teacher Training

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The Goldstone Apple-Valley Radio Telescope (GAVRT) program (http://www.lewiscenter.org/gavrt) and The Radio Jove Project (http://radiojove.gsfc.nasa.gov) have a recent partnership to train K-14 teachers to use radio astronomy telescopes as vehicles for science education. The partnership is part of the NASA Juno mission to Jupiter (2011 launch) education and outreach program. Teachers attend training workshops to operate a 34-meter radio telescope and/or build or operate their own simple radio telescope, both of which can be used directly in the classroom. Corresponding lesson plans and curriculum material are available on the websites. Three teacher training workshops for the GAVRT/Jove program were held in 2010 and the results of the training and usage in the classroom will be reviewed. We plan to expand teacher opportunities in 2011 by offering web-based training programs.

http://www.lewiscenter.org/gavrt/opportunities.php

**ED53A-0528 Poster**

Using Telescopic Observations to Explore the Science of AGN with High School Students

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Over the past several years the NASA E/PO Group at Sonoma State University has operated a small robotic telescope in northern Sonoma County, California. The telescope is used by high school and college instructors and their students from around the United States. Observations have been used both in classroom settings and in after-school or extracurricular activities. It has also been central over the past two summers (2009/2010) as part of a summer science internship program for Sonoma County high school students. The program gave these students an in-depth experience collecting and analyzing astronomical data. This poster describes some of the ways that the telescope has been used to make scientific measurements (as opposed to “pretty pictures”) of astronomical phenomena in high school settings. Some of the obstacles to implementing a set of astronomical observations in the high school classroom will be described, as will the steps we have taken to overcome them. Information is provided on how instructors can become involved in using the telescope and what support is available to help them get started in their classes.

**ED53A-0529 Poster [WITHDRAWN]**

An Astrobiology Summer Program for High School Teachers and Students

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The Georgia Tech Center for Ribosomal Origins and Evolution, a center funded by the NASA Astrobiology Institute, developed an educational summer program titled, “Life on the Edge: Astrobiology.” The purpose of the program was to expose high school educators to the field of astrobiology and provide them with skills and classroom activities necessary to foster student interest in scientific discovery on Earth and throughout the universe. Astrobiology activities for a week-long summer enrichment program for high school students was developed by three high school educators, two undergraduate students and faculty in the Schools of Biology, and Chemistry and Biochemistry at Georgia Tech. Twenty-four high school students were introduced to hands-on activities and techniques such as gel electrophoresis, thin layer chromatography, and manual polymerase chain reaction. The impact of the astrobiology summer program on teachers and high school students will be discussed.

**ED53A-0530 Poster**

The Impact of Positive Role Models on the Success of Students Involved in Original Scientific Research

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To maximize student understanding of the methods of science via performance of authentic scientific research, a mentorship program for middle school students was developed for the 2010 - 2011 school year. A population of 8th grade science students will be selected from a district middle school and be paired with secondary student mentors already conducting individual research as part of a successful preexisting science research program. Students will interact with mentors in a school setting to develop and implement original scientific research projects. Upon completion, students will present their findings at an interscholastic science symposium and/or an in-district science symposium. Students will also receive support from professional scientists at the University of Medicine and Dentistry of New Jersey through interactive visitations and electronic communication. In an effort to provide diverse role models, mentors from a variety of racial, ethnic, and gender groups will participate. Student success will be evaluated through questionnaires, symposium participation and monitoring of future participation in authentic research programs as participants make the transition from middle to high school.

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