Teacher Professional Development Programs Promoting Authentic Scientific Research in the Classroom I

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**ED33D-01**

Creating a 21st Century Community through the Teacher Research Experience (Invited)

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In the spring of 2009, I participated in PolarTREC - Teachers and Researchers Exploring and Collaborating, a Teacher Research Experience (TRE) funded by the National Science Foundation and managed by the Arctic Research Consortium of the United States. I assisted in hands-on research being performed by scientists with OASIS (Ocean, Atmosphere, Sea Ice and Snowpack) during their field campaign in Barrow, Alaska. Although I was in the field for only 3 weeks, it was merely a beginning to a transformation that took place not only in me, but also among all of those involved. The PolarTREC program embodies the principles fundamental to the 21st Century skill-set that we want our students to possess. The job market is changing for graduates, and education is striving to provide students with the skills necessary to thrive in the future. To ensure the success of students the International Society for Technology Education (ISTE) has defined 21st Century Skills. They are incorporated into many educational standards (such as the Arizona Educational Technology Standards) and they are practiced by the teachers, researchers, students and the PolarTREC community. They are: <ul> <li>Creativity and Innovation <li>Communication and Collaboration <li>Research and Information Literacy <li>Critical Thinking, Problem Solving, and Decision Making <li>Digital Citizenship <li>Technology Operations and Concepts</ul>

**ED33D-02**

A Teacher Professional Development Program for an Authentic Citizen-Science Program: GLOBE at Night

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An authentic science research program in the classroom can take many forms as can the teacher professional development that accompanies the programs. One different approach invites educators to invoke 21st century skills with their students while focusing on a real-world issue of both local and global concern. The citizen-science program on light pollution, GLOBE at Night, has students and the general public measure the darkness of their local skies and contribute observations online to a world map. They do this by looking toward Orion for the faintest stars and matching what they see to one of seven different star maps. (For more precise measurements, digital sky-brightness meters are used.) These measurements can be compared with data from the previous 4 years, as well as with satellite data, population densities, and electrical power-usage maps. Measurements can be examined online via Google Earth or other tools and are downloadable as datasets from the website. Data from multiple locations in one city or region are especially interesting, and have been used as the basis of research in a classroom or science fair project or even to inform the development of public policy. This year, GLOBE at Night has been expanding its role in training educators on fundamental concepts and data collection to include more data analysis for a topical variety of local projects. Many on-site workshops have and are being given to teachers in grades 5 through high school. Some of the U.S. school communities created mini-campaigns that combined local students with public advocates and representatives from local city and county governments, and also collaborated with students in Wales, Canada, Romania and north-central Chile (near major observatories). Internationally, training has been given via on-line forums, telecon-powerpoint presentations, videoconferencing via Skype, and blogs. Informal educators have come from national and international networks of science, technology and nature centers, as well as amateur astronomer associations. From these various experiences, we will discuss success stories and lessons learned as well as future plans for sustainability. This work was supported by a grant from the National Science Foundation (NSF) Astronomy Division. GLOBE at Night is hosted by the National Optical Astronomy Observatory, which is operated by the Association of Universities for Research in Astronomy (AURA), Inc. under cooperative agreement with NSF.

http://www.globe.gov/globbeatnight/

**ED33D-03**

Teacher Research Programs Participation Improves Student Achievement in Science

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Research experience programs engage teachers in the hands-on practice of science. Program advocates assert that program participation enhances teachers’ skills in communicating science to students. We have measured the impact of New York City public high school science teacher participation in Columbia University’s Summer Research Program for Science Teachers on their students’ academic performance in science. In the year prior to program entry, students of participating and non-participating teachers passed a New York State Regents science examination at the same rate. In years three and four following program entry, participating teachers’ students passed Regents science exams at a higher rate (p = 0.049) than non-participating teachers’ students. Other
program benefits include decreased teacher attrition from classroom teaching and school cost savings.

http://www.ScienceTeacherProgram.org

ED33D-04

From Beacon Valley, Antarctica to Mars: Bringing the PolarTREC Teacher Research Experience to the Classroom

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PolarTREC is an educational research experience in which K-14 teachers participate in polar research with scientists as a pathway to improving science education. The program is funded by the National Science Foundation and managed by the Arctic Research Consortium of the United States. Teachers share their experiences with scientists, educators, communities, and students around the world during the expeditions through online journals, and translate the experience to the classroom by developing curricula based on the research expedition. A 2008 PolarTREC teacher research experience involved drilling through buried ice beneath glaciers in one of the Dry Valleys located in the cold-polar desert region of Antarctica. PolarTREC teacher Jacquelyn Hams accompanied Boston University researchers Dr. David Marchant and Sean Mackay to Beacon Valley, Antarctica. Beacon Valley is significant because the ice beneath it is estimated to be over several million years in age, making it the oldest ice known on this planet and it is one of the most Mars-like climatic environments and landscapes on Earth. In order to translate this unique environment to the classroom, lesson plans were created for students to study the topography, glacial landforms, and wind patterns of Beacon Valley. Students also examine the same imagery that scientists use to study the processes that operate in the extreme environments of Antarctica and Mars. The topographic maps and aerial images of Beacon Valley were obtained from the NASA LIMA (Landsat Image Mosaic of Antarctica) website and Mars imagery was obtained from the University of Arizona HiRISE (Hi Resolution Imaging Science Experiment) website. Wind data was downloaded from an anemometer in Beacon Valley and provided courtesy of Sean Mackay of Boston University. The lesson plans are available through the PolarTREC website or by contacting Jacquelyn Hams at hamsje@lavc.edu.

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