8A.6 EARTH2CLASS: CONNECTING TEACHERS AND RESEARCHERS

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1. INTRODUCTION

The Earth2Class (E2C) Workshops for Teachers at the Lamont-Doherty Earth Observatory of Columbia University (LDEO) provide an effective model for improving knowledge, teaching, and technology skills of middle and high school science educators through ongoing interactions with research scientists and educational technology (www.earth2class.org). With support from NSF Geoscience Education grant 0331232, our program has developed monthly workshops, web-based resources, and summer institutes in which classroom teachers and research scientists have produced exemplar curriculum materials about a wide variety of cutting-edge geoscience investigations suitable for dissemination to other teachers and their students.

Some of the main goals of this program are focused to address questions such as: (1) What aspects of the E2C format and educational technology most effectively connect research discoveries with classroom teachers and their students? (2) What benefits result through interactions among teachers from highly diverse districts and backgrounds with research scientists, and what benefits do the scientists gain from participation? (3) How can the E2C format serve as a model for other research institution-school district partnerships as a mechanism for broader dissemination of scientific discoveries?

2. E2C WORKSHOPS

For nine years, classroom teachers have had opportunities to participate in monthly meetings with LDEO research scientists. During the past few years with NSF support, these programs have expanded into the following format:

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9:30 – 10:15 Introductory presentation
10:30 – 12:00 Scientist presentation
1:00 – 1:45 Working lunch
2:00 – 3:30 Curriculum and educational technology development

The main purposes of the Workshops are to provide teachers with enhanced content knowledge in the Earth Sciences, develop their skills to incorporate improved electronic and hands-on investigations, and return to their classrooms with increased enthusiasm for sharing what they have learned. We have made a special effort to increase the competency to teach the Earth Sciences of K–12 teachers serving in schools with high numbers of students from underrepresented groups, thereby providing greater role models to attract students into science and math careers.

Most of the participants are middle and high school Earth Science teachers from the New York City metropolitan area, including northern New Jersey. Some come from as far away as Maryland. Support from the NSF grant covers all program expenses, except for tuition paid by those who chose to register for graduate credit through courses at Teachers College, Columbia University, and St. Thomas Aquinas College. All receive certificates of attendance which can be used for district staff development credit.

During the past two years, over a hundred teachers have completed the online registration form and attended one or more sessions. Average attendance for sessions has been approximately twenty-five.

3. E2C WORKSHOP THEMES

Selected examples of recent Workshop themes and scientists include:

- “Tree Rings and Climate Change” with Nicole Davi (Jan 2005)
- “Earthquakes and Mid-Ocean Ridge Spreading” with Maya Tolstoy (Mar 2005)

- "Under 4 km of Ice: Studying Lake Vostok" with Michael Studinger (Apr 2005)
- "NASA Goddard Institute for Space Studies Educational Global Climate Model" with Mark Chandler and Steve Richards (Sep 2005)
- "From Satellites to Microscopes: Studying Phytoplankton" with Ajit Subramanian and Andrew Juhl (Nov 2005)
- "Could Global Warming Mean Less Sunshine and Less Rainfall" with Beate Liepert (Jan 2006)

  [Note: Liepert was one of the scientists featured in a NOVA program about global dimming that aired shortly after this Workshop.]
- "News from the Deep: Integrated Ocean Drilling Program's Latest Discoveries" with Gerardo Iturrino (Apr 2006)

Links to all workshops are provided through http://www.earth2class.org/sitemap/e2cthemes.php. Since it is not possible to include all LDEO scientists in this program, a link to other research is provided at http://www.earth2class.org/er/ldeo/.

The themes reflect the range of research conducted at LDEO, so with respect to the themes of this EWOC Conference, Workshop participants have learned much more about cutting-edge investigations into ocean and climate questions than about weather. However, as most possess good familiarity about the latter through what they teach within their curricula, the exposure to less familiar concepts has been rated beneficially in evaluations.

Dr. Dallas Abbott and E2C participants during a visit to the LDEO Deep-Sea Sample Repository

4. E2C WEBSITE

www.earth2class.org has become an important resource for Earth Science educators. Through one of the pull-down menus, archived versions of past "Workshops" provide an effective format for disseminating results of scientific research to teachers and students. Individual Workshop archives include Passow's introductory PowerPoint. All of these are available through http://www.earth2class.org/sitemap/mjppresentations.php).

Each Workshop also has links to the scientists' research. When possible, scientists provide their PowerPoint presentations; however, many times they are presenting then-unpublished information, which participants can only obtain afterwards through the scientists' home pages when it eventually becomes available. These may be examined by theme through http://www.earth2class.org/er/teachers/resources/scientists.php.

The archives also include suggestions for classroom applications, and additional images and resources. Participants have sometimes been inspired to work with the scientists after a session to create lesson plans, which are then posted in the "Classroom Resources" section of the archived web page. One example is "Amazon River Plume Inquiry Activity" created by Deena Bollinger of South Orangetown Middle School.

Graduate education students from Teachers College, Columbia University, and St. Thomas Aquinas College enrolled in courses held in conjunction with the E2C Workshops have also contributed to the website offerings through their course projects. One example is "What Can Phytoplankton Tell You about the Nitrate and Phosphate Levels of the Oceans?" by Karen Cole, created with feedback from Subramanian and Juhl after their program.

During the summers of 2004 and 2005, selected participants gathered for curriculum development workshops to create examples of classroom-ready lessons based on E2C Workshop themes. Two examples pertinent to the theme of this Conference are "Understanding Weather" and "Watersheds." Curriculum development workshops during the academic year produced additional lesson plans, such as "You, the Scientist".

The March 2005 Workshop provided a special opportunity to bring middle school students to LDEO to meet Maya Tolstoy, one of the scientists featured in the James Cameron IMAX film, "Aliens of the Deep," which had premiered a month earlier. Students from local schools not only were inspired by hearing first-hand about oceanography research, but also were able to read about themselves in a story about the program that appeared in the regional newspaper. It is, of course, too soon to determine

the impact of such student-scientist interactions, but it is possible that such encounters may be a career-deciding factor for one or more of the students.

Dr. Maya Tolstoy with White Plains Middle School students attending her E2C Workshop

Another pull-down menu on the web site provides a variety of "Educational Resources." These include extensive curricular materials for students and teachers created by Passow, E2C participants and scientists, and other educators. Although many are geared toward the New York State "Regents Earth Science" courses taught by many participants, teachers from many other states have utilized what is found here. Tracking access to the site indicates an average of nearly 13,000 visits per month over the past year.

The "Educational resources" section also includes suggestions for effective integration of educational technology strategies, and links to National and state Science Education Standards. There is also several "Virtual Tours." One, "Reading the Trees on the Lamont Campus Forest," describes LDEO research about recent climate change using dendrochronology. Another pertains to the kayaking trips on the Hudson River which have become the traditional way to conclude each year's Workshop series.

5. ADDITIONAL CURRICULUM DEVELOPMENT

During the summers of 2004 and 2005, E2C sponsored "Earth Science Teachers Conferences" that brought together educators from across New York and New Jersey to consider some of the challenges facing classroom teachers in trying to incorporate recent research discoveries into the curriculum. Their efforts led to creation of a valuable web-based resource of Earth Science Curriculum Units. This includes succinct statements of key ideas, NYS Core Concepts, essential vocabulary lists, selected labs and activities, and links to web sites providing scientific information that may not be incorporated into textbooks for years.

The NSF provided a collaborative research grant to three LDEO scientists, Jeffrey Weissel, Marie-Helene Cormier, and Kori Newman, to study fluid expulsion in the large-scale elongated gas blowouts offshore of Virginia and North Carolina. A three-day "E2C-type" Workshop was utilized to disseminate their results more widely into middle and high school classrooms. A dozen teachers worked with the scientists to create a variety of presentations, curriculum materials, and other resources about methane hydrates (http://earth2class.org/er/Gas%20Blowout/Logistics/gasblowoutsummary.php). Results of using such an approach were presented at the 2005 AGU meeting. The E2C website includes the PowerPoint used for this session.

"Gas Blowout" Workshop participants developing curriculum materials about methane hydrates and climate change.

6. THE FUTURE OF E2C

Over the past few years, E2C has explored a variety of ways to make a significant contribution toward local and national efforts to create networks of science researchers working with classroom teachers and teacher-trainers seeking effective methods for innovative instructional techniques, problem-solving strategies, and professional development, as well as meeting the challenges of state and national mandates. Initial support from the NSF Geoscience Education comes to an end in December 2006, and new sources for support are being sought. However, even without external funding, the Workshop series will continue for the rest of the upcoming academic year.

The E2C website will continue to be maintained and expanded. Some portions date back to the start of the online version of E2C, and used technology available then which has subsequently been superseded. So during the summer of 2007, the site will undergo a thorough revision and enhancement, to be sure that all components provided effective resources utilizing

current technologies.

Also planned are closer connections between the topics included in middle and high school Earth Science curricula and E2C resources. Certain areas, including weather, are under-represented in the Workshops because few LDEO scientists engage in such investigations. Strategies to connect to such research elsewhere are under consideration. Future plans for E2C will ultimately depend on opportunities made available by new NSF and other initiatives.

The three questions posed above will be more thoroughly answered in reports and more extensive articles now in preparation. But brief answers might be:

(1) What aspects of the E2C format and educational technology most effectively connect research discoveries with classroom teachers and their students? "Live" Workshop sessions, archived versions of these, and on-line resources.

(2) What benefits result through interactions among teachers from highly diverse districts and backgrounds with research scientists, and what benefits do the scientists gain from participation? Teachers gain new knowledge and inspiration to enhance their work with students, as well as a wide variety of classroom-ready resources. Scientists gain an effective format for wider dissemination of their research results, as well as occasional questions from teachers that throw new light on their work.

(3) How can the E2C format serve as a model for other research institution-school district partnerships as a mechanism for broader dissemination of scientific discoveries? Other institutions can consider the E2C model when designing educational outreach programs to showcase the work done by their investigators. Perhaps support can be found to provide Workshops elsewhere to E2C participants.

7. ACKNOWLEDGEMENTS

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Dr. Neil Pederson explaining use of dendrochronology to study climate change in northeastern North America

Dr. Kim Anne Kastens and participants in the Second NYS Earth Science Teachers Conference during a field experience