

An Evaluation of the Earth2Class Program at the Lamont Doherty Earth Observatory

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Introduction

Earth2Class (E2C) is a unique program which brings the forefront of scientific research into K-12 classrooms. Through a multi-faceted approach, the E2C program at Lamont Doherty Earth Observatory (LDEO) has implemented some of the most advanced professional development (PD) available to K-12 educators.

This report will examine several aspects of the E2C program. These include: 1) responses from participants in the PD workshops, 2) curricular materials developed by the E2C staff and participating scientists, 3) web-based instructional resources developed by E2C or E2C participants and 4) a summary evaluation of the program. The summary evaluation is provided for inclusion in the NSF final report.

Responses from E2C Participants and Evaluator's Comments

Over the course of approximately twelve months, comments from E2C participants have been solicited. The solicitation of these comments was with special reference to the effectiveness of the E2C program. Reactions were garnered through face to face meetings, personal via e-mails and from open comments posted on the ESPRIT listserv (<http://external.oneonta.edu/mentor/listserv.html>). The original intention was to compile a statistical study of favorable and unfavorable opinions. However, after the initial responses, it became apparent that this would be unnecessary. The responses of participants (n = 22) in E2C programs have been overwhelmingly positive. Participants were unanimous in their opinion that their professional development through E2C has been in depth, enriching and had positive effects on their teaching.

E2C participants were very appreciative of the opportunity to learn about cutting edge science and to interact with some of the finest researchers in the world. Respondents were approximately evenly divided as to which aspect they found most beneficial: learning about scientific developments or interacting with scientists. Some participants indicated that they were able to immediately share aspects of the E2C programs with their students (for example, A. Lerner-Lam's presentation on natural disasters, K. Jacob's presentation on earthquakes and more recently on hurricanes, etc.). Others indicated that their participation in the workshops was more for their own edification and that they did not share program aspects with their students. However, these participants also suggested that their participation in the program had elevated their overall excitement about science and the teaching of science and that this excitement had a noticeable effect on the atmosphere in their classrooms.

The vast majority of respondents (there were only two exceptions) indicated that the accessibility of the scientific information was the key to the benefits that they derived from the program. The E2C workshop format includes a “background” presentation prior to presentation of research by participating scientists. These background presentations are provided by Dr. Michael J. Passow, a renowned K-12 educator. Many respondents (approximately 2/3) indicated that without this background preparation, the presentations by the participating scientists would have been nearly unintelligible. The two participants that were exceptions indicated that the workshops that they attended were on subjects about which they already had considerable knowledge, but that they enjoyed and benefited from the background presentations nevertheless.

The E2C website contains a wealth of supporting information which extends the benefits of each workshop to teachers that did not participate. This supporting information includes links to the introductory presentation for each workshop, the research presented, classroom and other resources, evaluation and multimedia. The introductory presentations are well organized and are of uniform quality across all of the workshop entries that were reviewed. The research presentations vary in completeness and reflect the idiosyncratic styles of individual presenters. Classroom and other resources are complete for most workshops reviewed, but there are some gaps. None of the workshop sites reviewed had links to Technology Integration. This portion of the E2C website appears to be the last to be developed. One undeveloped section in this expansive web resource is a minor omission. The reviewer encourages the E2C staff to develop this resource.

From this feedback, it would appear that the E2C program is highly effective and that participants not only enjoy the program, but they also derive considerable personal and professional benefits from participation. These benefits are having a noticeable effect in K-12 classrooms. The E2C staff have clearly hit upon a successful strategy for making cutting edge science accessible to K-12 teachers, who can then further translate these findings and share them with their students.

The success of the E2C approach does seem to depend, to a large extent, on the remarkable abilities of Dr. Passow to make the science accessible to teachers with more limited backgrounds in the content matter of each workshop. Although this approach is clearly working well, this evaluator has concerns regarding the scalability of the project. There are few places in the country that have the concentrated pool of research talent that is available at LDEO. Likewise, there are few providers of PD that possess Dr. Passow’s expansive pedagogical content knowledge and wealth of experience in delivering successful PD for K-12 teachers. These deficiencies in other locations may make it difficult to successfully replicate the E2C model.

However, even if the E2C format cannot be replicated, there is incredible potential for continuing the success of E2C at LDEO. LDEO is strategically located in proximity to a vast pool of teachers in the New York City School System and in a broad array of suburban districts. E2C can provide high quality PD for literally thousands of science teachers in this area. As noted by the New York State Regents Task Force on Teaching (RTFT), *“Professional development makes a difference in student learning”* (RTFT, 1998, p. 26). Nowhere in New York State is the need for PD greater than in the New York metropolitan area. Therefore, LDEO and E2C are poised well to address a portion of the most severe need in the state. It is much to the credit of the E2C staff that they hold workshops not only in the wealthy suburbs (White Plains Middle School), but also in an area where the need for high quality PD is especially acute (PS/MS 306 in The Bronx).

Curricular Materials Developed through E2C

New York joined the movement of standards-based education in science with the publication of the Learning Standards in Mathematics, Science and Technology (1996), an adaptation of the National Science Education Standards (NRC 1996). Owing to the broad, general nature of the MST standards, teachers lobbied the New York State Education Department (NYSED) for greater clarification as to exactly what they should be teaching. In Earth Science, NYSED responded with the Physical Setting: Earth Science Core Curriculum, which was released in 1999. This document serves as the basis for the summative assessment of student learning that is the Regents Examination in the Physical Setting: Earth Science. In fact, it was designed as a blueprint for assessment and not instruction, which accounts for the “teacher hostile” nature of the document as noted by Ebert, et. al. (2004). This brief account of the current state of the Earth Science curriculum in New York is essential background for understanding the evaluation of the curricular efforts associated with E2C which follow.

Professional development and curriculum are inextricably linked. Ebert, et. al. (2004, p. 10) note that the Regents Task Force on Teaching report implies that a majority of PD should be discipline specific and linked to student learning needs (RTFT, 1998, p. 24). Hence, there is a clear link to curriculum. Despite this obvious linkage, New York has failed to provide its teachers of Earth Science with a comprehensive, detailed syllabus for instruction and has provided virtually no PD related to development of curricula. E2C has emerged as one of the few lights in this vast, dark void in curriculum and professional development. The success of E2C in PD has been noted above. Therefore, this section will focus on aspects of curriculum development.

E2C has hosted two conferences for teachers of earth science. The second of these conferences was devoted to pooling teacher talents and beginning to develop a curriculum and associated instructional materials, which would be available to all teachers. Obviously, such a contribution would be of value to any teacher of earth science, but it is especially a service to new teachers.

Elements of the E2C-developed curriculum are currently available on the E2C website. These Earth Science Curriculum Units include an overview, pertinent readings, related E2C workshops and resources, general key concepts, a series of questions regarding the key concepts, instructions to participants to identify resources in DLESE and a suggested list of materials, appropriate standards, etc. which participants may wish to include when planning their individual courses. As was the case with the workshop web pages, most of the Educational Technology sections are not developed currently.

The Earth Science Curriculum Units are a work in progress, but clearly there is much here that would benefit teachers. Although the curriculum units are not complete, they provide, at the very least, a starting point for teachers to plan curricula which is superior in organization to the standards-based structure of the state-provided core curriculum. In addition to this beginning framework, many of the curriculum units include teacher-developed materials, some of which are of exemplary quality. These teacher-developed materials are critical resources for new teachers of earth science. Moreover, by making available E2C web space, the program is providing an additional vehicle for PD by encouraging teachers to develop and share innovative lessons.

The E2C website also provides access to a rich array of other curricular resources including web pages developed by other teachers of earth science who may or may not be associated with E2C. These teacher-developed pages contain numerous ideas for labs and lessons and some include course outlines which complement the E2C Curriculum Units. The inclusion of this resource on the E2C site makes E2C one of a very few “one stop shopping” resources for teachers of earth science. Owing to the comprehensive nature of the site, E2C should rapidly become a first destination for teachers that are new to earth science and for veteran teachers in search of new ideas to re-invigorate their courses.

Web-based Instructional Resources

The web-based instructional resources provided by E2C fall into three main groups which have been discussed above. These are 1) materials associated with E2C workshops, 2) E2C Earth Science Curriculum Units (with associated teacher-developed instructional materials) and 3) teacher-developed web sites which are external to E2C. In the first two groups of resources, there is sufficient information to assist teachers in developing their own courses. As noted above, both of these sections lack development of the sections on Technology Integration, but this is not critical to the utility of these resources.

The materials that are associated with the E2C workshops are the most completely developed resources, which is fitting as these are the centerpiece of the E2C program. The comprehensive nature of the introductory materials prepared by Dr. Passow makes these sites very accessible. In addition, some of the presentations by researchers have been augmented by instructional materials (e.g., PowerPoint presentations) developed by the researchers. Many topics have clear and strong linkages to the NYSED core curriculum, whereas others may be considered more of an exercise in enrichment. In both cases, the centrality of the nature of science is quite apparent and this theme is an integral part of the NSES and the NYSED core curriculum. Therefore, in no way, can any of the E2C workshops be regarded as esoteric.

The web-based instructional materials available through E2C cover numerous specialized topics and provide a skeletal structure for development of curricula. It is difficult to think of other web-based resources that are as comprehensive as those provided by E2C. The developers of the E2C website are to be commended for both the volume and quality of resources that they make available.

Final comments regarding the web-based resources deal with the format of the website. With the volume of material available through E2C, it might be easy for a visitor to the site to be overwhelmed. However, the E2C homepage is clearly organized and easy to navigate. The Quick Links section is especially useful. Likewise, information on upcoming conferences and workshops is easy to locate. There are easily accessed links to sections for both teachers and students related to the E2C workshops. For each workshop, the standard format with icons for the introduction, the research, classroom resources, technology integration, resources, evaluation multimedia and the workshop registration form is also easy to navigate. However, as noted above, the technology integration sections are generally empty.

After numerous visits to the E2C site, the reviewer would like to offer two relatively minor suggestions for improvement of this valuable resource. The first suggestion deals with format. I have accessed the site from several different computers and on each machine, when the site opens; it only fills about two thirds of the monitor's display. The right hand third of the screen is generally white. As a consequence, many of the fonts on the website appear quite small. It may

require a significant amount of time to reformat all of the E2C pages, but the effort would be well worthwhile as it would make the site more visually appealing and easier to use.

The second suggestion is a minor suggestion regarding organization. Currently, past workshops are listed by year of presentation. This chronological listing is most appropriate for current workshops, but for past years, it is an artifact which makes workshop information less accessible. It would be very beneficial if past workshops could be re-listed by major topic area (e.g., meteorology, etc.) or, better still, by curricular association. In this way, teachers could easily access E2C resources associated with whatever topic area prompted them to visit the E2C site. Again, these are minor suggestions made to enhance the utility of what is already an extraordinarily valuable resource.

Summary Evaluation

Earth2Class (E2C) is a unique program which brings the forefront of scientific research into K-12 classrooms. Through a multiple paths, the E2C program at Lamont Doherty Earth Observatory (LDEO) has implemented advanced and innovative professional development (PD) for K-12 educators. Aspects of the E2C program evaluated include: 1) responses from participants in the PD workshops, 2) curricular materials developed by the E2C staff and participating scientists, 3) web-based instructional resources developed by E2C or E2C participants. Evaluation of these areas is summarized in this section.

E2C Workshops

Comments (n = 22) gleaned from teachers participating in E2C workshops were unanimous in their opinion that their professional development through E2C was in depth, enriching and had positive effects on their teaching. These teachers enjoyed learning about cutting edge research and interacting with scientists working at the forefront of earth knowledge. Many participants indicated that they intended to or already had used portions of E2C programs in their classrooms. The E2C workshops are a very successful strategy for making cutting edge science accessible to K-12 teachers, who, in turn, share these developments with their students.

The success of these E2C workshops derives largely from the inclusion of background information for participants presented by Dr. Michael Passow prior to the research presentations. This background information, along with the research presentations, is available on the E2C website, which further extends the PD available through the program. Links to Technology Integration are available on the E2C site, but are not yet developed. However, this does not impair the value of an exceedingly strong web resource.

The great success of the E2C workshops stems from Dr. Passow's ability to make the science accessible to teachers. This dependence on the unique abilities of a single individual poses concerns for the scalability of the E2C approach, but at the same time represents an enormous resource in the New York metropolitan area where there is a critical need for PD. It is especially noteworthy that the E2C workshops are conducted not only in the wealthy suburbs, but in the Bronx as well.

E2C Curricular Materials

The Second Annual Earth Science Teachers Conference, hosted by E2C and LDEO, was devoted to developing curriculum and instructional materials to be available for all teachers

of earth science. This effort is the only attempt at development of curriculum for dissemination in New York State. Elements of this E2C-developed curriculum are currently available on the E2C website. These Curriculum Units represent a starting place for any teacher needing to develop or revise curriculum in earth science. Some units also include well developed instructional materials designed to meet the curricular goals. E2C Curriculum Units and associated instructional materials are critical resources, especially for new teachers.

The E2C website also acts as a portal for additional curricular resources hosted on websites developed by numerous teachers. This is an especially valuable feature of the E2C site.

Web-based Instructional Resources

E2C provides web-based instructional resources to accompany PD workshops and broad-based curricular materials (discussed above). The resources that are associated with the E2C workshops are thoroughly developed and extend the PD that the workshops provide to teachers that were not workshop participants. These resources are comprehensive and, most importantly, include the introductory presentations which make the research presentations accessible. All of these resources stress the nature of science as a way of knowing. The E2C website is well organized and easily navigated. Only minor suggestions for improving the format and organization of parts of the website are offered.

Summary Conclusion

In conclusion, the Earth2Class program and its associated resources provide unique, high-quality professional development to both teachers that participate in the E2C workshops and to those that seek on-line professional development and/or useful classroom materials and ideas. The E2C website promises to be a site of first choice when searching for curricular materials. Although there are negligible concerns regarding the scalability of the program, Earth2Class has proven that cutting edge research in the earth sciences can be made accessible to classroom teachers, who, in turn, can share exciting research with their students. The E2C concept clearly warrants further exploration and testing at other sites. This exciting, innovative program has successfully modeled a synergistic relationship between notable scientists and K-12 teachers. Through this program, K-12 teachers receive unparalleled professional development and researchers are provided with a clearly delineated, direct means of achieving their mandated education and public outreach (Criterion 2) responsibilities. One can hardly imagine a more fruitful, win/win situation. This evaluator conveys his highest, unreserved commendation for the Earth2Class initiative.

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