Proof-of-Concept: NSF Geoscience Education Division (Grant 0331232)
Earth2Class
Formative Evaluation Report

Dr. Pearl Solomon
Professor-Emeritus
St. Thomas Aquinas College, Sparkill, NY

Earth2Class (E2C), is a unique Professional Development project based at the Lamont-Doherty Earth Observatory (LDEO) of Columbia University in Palisades, New York

This program was funded and implemented for the purpose of improving the knowledge, teaching, and technology skills of middle and high school science educators through ongoing interactions with research scientists and educational technology. The questions to be answered as evidence of the effectiveness of the program concept include:

- Can teachers and scientists working together through monthly workshops, web-based resources, and summer institutes produce exemplar curriculum materials about a wide variety of cutting-edge geosciences investigations suitable for dissemination to other teachers and their students?
- What mutual benefits result through interactions among teachers from highly diverse districts and backgrounds and research scientists?
- How can the E2C format and educational technology most effectively bring research discoveries to teachers and their students?
- Can the E2C format serve as a model for other research institution-school district partnerships as a mechanism for broader dissemination of scientific discoveries?

Through this project, the existing Earth2Class was expanded to address these goals:

- Training of selected cohorts of teachers from the New York metropolitan area and elsewhere to enhance curriculum content knowledge in the Earth Sciences, develop skills to incorporate improved electronic and hands-on investigations, and increase student achievement on elementary, middle and high school mandated assessment tests.
- Utilize these trained teachers to increase the competency to teach the Earth Sciences of other teachers serving in schools with high numbers of students from underrepresented groups, thereby having a broad impact and providing greater role models to attract students into science and math careers.
- Contribute to the national effort 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 curriculum standards and assessment mandates.
- Explore innovative strategies for teacher professional development based on existing and emerging educational technologies.

> Engage both classroom educators and research scientists in expanding the knowledge base on which to develop Centers for Learning and Teaching and other professional continuum programs.

Overall Evaluation Plan

The evaluation instrument components of the Earth2 class program are directly based on the objectives.

1. The scope of the program and its ability to reach teachers is easily demonstrated thru its web-site, http://www.earth2class.org/ and attendance figures which surpass expectations. The web site describes each program presentation. As many as ___ teachers have attended at least one of the workshops and a consistent number have attended most.
2. Since the objectives weigh heavily on the development of teacher-friendly electronic media products for direct use by teachers, the project web-site is in itself a proof of concept. For example, the curriculum components produced by the involved teachers are now available to all, http://www.earth2class.org/er/teachers/lessonplans/index.php
3. In addition, direct pre and post participation teacher-completed evaluation surveys to collect both quantitative and qualitative data were conducted and analyzed.

Quantitative Data Instrumentation and Collection

The instrument below was applied as follows:

> As pre-participation data collection from participants in the summer 2004 curriculum development component
> As post- participation data collection from three groups of participants; the above curriculum writers, the participants who came for course or inservice credit.
> Data was collected both in person and in follow-up e-mail

Dear Earth2class Participant,

We hope you enjoyed and benefited from your attendance at our programs. At this time, we need to evaluate the effects of our program so that we may plan for future offerings. Evaluation is also important for continued funding. If you use your e-mail reply feature you should be able to enter your responses directly- or if you wish, use the attachment and send me the completed form similarly.

Thank you for taking the time to do this and looking forward to seeing you again.

Sincerely,

Pearl Solomon (Program Evaluator)
pgsolomon@msn.com

__ Place an X here if you participated in the summer 2004 curriculum workshop:
___ Place an X here if you attended the series for college credit:
___ Place an X here if you attended for in-service credit:

____What is the total number of workshops you attended?

A. For each item below indicate the increase in your knowledge 1= No new knowledge, 2= Some new knowledge, 3= Considerable new knowledge, 4= A great deal of new knowledge

Knowledge Construct	Level of increase
Knowing the current terminology for curriculum design including terms such as: key idea, performance indicator, embedded concept; commencement, benchmark, and course levels.	
Knowing how the state curriculum guide relates to your classroom curriculum.	
Knowing how to trace or "design down" from the state curriculum guide to the desired specific understandings or embedded knowledge outcomes for my students	
Knowing how a particular assessment item is matched to a particular performance indicator.	
Knowing the latest Earth Science research.	
Knowing how to use the Internet to research data and laboratory activities that have the greatest potential for student achievement	
Knowing how scientists use data in their research	
Knowing how to use assessment data to help guide my instruction	
Knowing how to use graphic representations of data, especially representing change over time.	
Knowing how to prepare an assessment item to check for understanding of embedded knowledge.	

B. Next to each of the following statements, place an X to indicate that the described change in your teaching has occurred (Do not check the others)
___I am more likely to refer to my state curriculum guide when planning a unit
___I am more likely to refer to my state curriculum guide when preparing an assessment
___I am more likely to use the Internet to research current findings
___I am more likely to engage my students in using Internet data
___I am more likely to engage my students in data gathering and graphic interpretation

C. Please write a paragraph or two that describes what you found most valuable in the Earth2Class experience, what you would like to see changed, and why you would or would not recommend the program to others.

Data Analyses

Knowledge Construct	Assessed Mean Pre-	Assessed Mean Post-	Effect Size
Knowing the current terminology for curriculum design including terms such as: key idea, performance indicator, embedded concept; commencement, benchmark, and course levels.	1.8	2.8	1.33
Knowing how the state curriculum guide relates to your classroom curriculum.	2	2.6	
Knowing how to trace or "design down" from the state curriculum guide to the desired specific understandings or embedded knowledge outcomes for my students	2	2.6	
Knowing how a particular assessment item is matched to a particular performance indicator.	1.83	2.2	
Knowing the latest Earth Science research.	1.83	3.8	2.66
Knowing how to use the Internet to research data and laboratory activities that have the greatest potential for student achievement	1.92	3.6	
Knowing how scientists use data in their research	1.83	3.6	
Knowing how to use assessment data to help guide my instruction	2	2.6	
Knowing how to use graphic representations of data, especially representing change over time.	2	3	
Knowing how to prepare an assessment item to check for understanding of embedded knowledge.	1.83	2.8	
Total Group Mean Scores/Effect Size	1.91	2.96	1.35

Post –participation dispositions: *

	% who checked
I am more likely to refer to my state curriculum guide when planning a unit	53
I am more likely to refer to my state curriculum guide when preparing an assessment	46
I am more likely to use the Internet to research current findings	87
I am more likely to engage my students in using Internet data	87
I am more likely to engage my students in data gathering and graphic interpretation	87

*All participants did not respond to this

The quantitative data reveal some interesting results that are supported by the qualitative results reported below. Overall effect size was significant. In simple terms there was a

25% increase in the level of self-evaluated teacher knowledge. The objectives to set up an interaction among teachers and scientist via interpersonal and electronic means were obviously achieved. An interesting variation was in the comparison of questions that dealt with these interactions specifically and those that dealt with applications to state curriculum guides and assessments. The affect on knowledge and use of these resources was not as significant as the affect on knowledge of the latest scientific research and use of the Internet. Effect size for these latter items was double that of the use of state resources. This, however, proves the direct relationship between program efforts and results since most of the effort was on the research, interaction and Internet opportunities. It, perhaps, also helps directs further efforts toward the less achieved outcomes.

Qualitative Results

The written evaluation instruments also had an open-ended section for comments by participants and the educational evaluator attended a number of sessions and spoke directly with participants. The comments overwhelmingly compliment the opportunity for new research knowledge and the interactions among themselves and the scientists.

> *We have dialogues about what is new or current and then bring it into the classroom. The teachers get to ask the scientists what the data is saying and what it all means.*
>
> *I found this program amazing in that teachers were exposed not only to cutting edge research but to the scientists who generated this knowledge.*
>
> *This provides a much more thorough and deeper understanding of my teaching subject matter so that I have greater confidence in transmitting ideas and knowledge to my students*
>
> *Another benefit is the interaction with other teachers who are also passionate life-long learners. Often this kind of collegial interaction is missing in individual schools.*
>
> *I would highly recommend that colleagues attend this program.*
>
> *The informal networking is a wonderful change of pace from the hectic weeekly schedule. I would recommend this program to others as an easy-going methd of deepening one's Earth Science knowledge content*
>
> *The e2class program gives teachers a great list of web*-sites to use.
> *I now use many internet sites from E2class for student lab work.*

One teacher, who commuted from Maryland for the workshops commented;

> *It is helpful contrasting New York, New Jersey and Maryland teacher objectives. If my colleagues had somewhere to stay like a dorm thy would come from Maryland*

Recommended changes were very limited. Participants mostly just wanted to keep the program as is. Important suggestions included:

More emphasis on teaching inner city kids.

Opportunity to bring the kids for a symposium with scientists.

Conclusions

The e2class project is a unique and effective professional development program that can stimulate teachers and keep them informed of the vital content they teach. It is a model worthy of duplication in other subject areas and across the country. It may help to retain the best of our teachers and overcome an unfortunate attrition rate. The direct contact with professional scientists and collegial interactions in a non-threatening professional environment are critical dispositional and cognitive components of this success.

The lack of connection to state curriculum guides and assessments is a concern that needs to be addressed. An exception to this is that teachers who were directly involved in constructing curriculum for their colleagues had a greater appreciation for its value. We therefore need to develop these opportunities further—improving the involvement of teachers in the presentation and sharing of written curriculum and making more direct connections between the scientist and science to the teacher and classroom.