P1.5 AMS' EDUCATION PROGRAM - A DECADE OF SUCCESS

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1. INTRODUCTION

The AMS Educational Program dates back to 1990 when the AMS Council initially committed resources toward implementing its "Educational Initiative" (Houghton 1990, 1991). To further develop a wide-ranging program that could significantly impact K-12 education, additional funding was sought from the National Science Foundation's (NSF) teacher enhancement program.

2. PROJECT ATMOSPHERE

In 1991, the cornerstone of the AMS Education Program was laid when the NSF provided funding for Project ATMOSPHERE with Ira Geer as Project Director. Project ATMOSPHERE was a major educational initiative directed toward the nation's primary and secondary schools through teacher enhancement and the development of instructional resource materials. The principal goal of the Project was to encourage studies of the atmospheric environment to stimulate young people to greater interest and study in science, mathematics, and technology. Project ATMOSPHERE would work with teachers to achieve this goal by providing them the background to use telecommunicated environmental data in the classroom. This background would be delivered through workshops conducted on behalf of AMS by a nationwide network of master precollege teachers, Atmospheric Education Resource Agents (AERA), using scientifically authentic, single-topic peer-training modules developed by the Project (Smith and Geer 1994).

The AMS' philosophy for a successful national teacher enhancement program was predicated on the concept that the system must be national in scope to impact the U.S. educational system, yet operate with a state focus as each state's educational system is unique, thus providing the desired local impact. AERAs, in partnership with the AMS, are master precollege teachers who are assisted by AMS to become knowledgeable in the foundations of atmospheric science. Those foundations were the basis for twenty single-topic modules that AERAs would present in workshops for their peers. Module topics included, for example, "Clouds", "Weather Satellites", "Hazardous Weather", "Weather Radar", and "Jet Streams" (Geer 1994).

A partnership was established with the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) to continue a two-week summer workshop held annually at the NWS Training Center (NWSTC) in Kansas City, MO. Graduate credit for workshop participation and subsequent inservice peer training is provided by the State University of New York (SUNY) College at Brockport. Alumni of the AMS/NOAA/NWS Kansas City workshop showing leadership in peer training are invited to become AERAs. AERAs also received additional training during successive summer workshops at NOAA and university facilities in Boulder, CO (1992, 1994, 1996) and Norman, OK (1993, 1995). The Kansas City workshop continues its annual offering now supported by AMS, NOAA and the NSF Atmospheric Sciences Division. To date, 291 teachers have been trained in the Kansas City workshops. AERAs and other Kansas City workshop peer trainers have provided about 5000 workshops for over 100,000 teachers. For more information, see *http://www.ametsoc.org/amsedu/aera/index.html*.

3. MAURY PROJECT

The success of Project ATMOSPHERE and its peer-training system inspired another proposal to NSF for a similar workshop on the physical foundations of oceanography. In summer of 1994 the first two-week workshop of the Maury Project was offered at the U.S. Naval Academy in Annapolis, MD. In addition to teacher training in the foundations of oceanographic

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science, ten companion single-topic teacher-training modules were developed, such as "Density-Driven Ocean Circulation", "Ocean Tides", and "Coastal Upwelling". To date, 222 teachers have been trained. In turn they have provided about 1300 peer-training sessions for over 13,000 teachers (Smith et al. 2002).

Initially funded by NSF, the Maury Project has received support from the Naval Meteorology and Oceanography Command and Office of Naval Research, NOAA, and the Maryland Space Grant Consortium, as well as the AMS. The U.S. Naval Academy provides major in-kind support for the summer workshop. For more information, see: *http://www.ametsoc.org/amsedu/maury/index.html*.

4. DATASTREME PROJECT

In 1995 NSF provided funding for a national teacher enhancement course on the basics of weather and climate created by the AMS Education Program. The DataStreme Project is offered through Local Implementation Teams (LITs) led by master precollege teachers with professional meteorologists and college science educators. Partially delivered via the Internet, the DataStreme Atmosphere course has proven to be a highly motivational and effective introduction to meteorology for K-12 teachers across the nation. Course learning materials include a custom textbook and a study guide. The study guide contains the first part of 24 investigations to be finished with activities written by AMS Education Program staff to near-realtime data and delivered twice weekly via the course homepage. Also delivered via the course homepage are daily national weather summaries and supplemental information files in addition to custom designed meteorological data products that are updated as frequently as hourly. The course covers twelve weeks with a chapter of the text setting the principal theme for each week's work. LITs meet at the beginning, middle and end of the semester with all participants, while assigned team mentors maintain weekly contact with each participant.

Evaluations completed by course participants at the end of the term have rated the course as "good" by 95%, the most positive of the three options. They have rated science content as 98% and materials and Internet course delivery approach as 91%. Peer impacts regarding weather content in their teaching even while taking the course averaged 3.9 for a total of 16,000 teachers while the total number of students impacted was over 600,000. Content mastery and pedagogical attitude are also assessed by surveys given at the beginning and end of the course. The survey uses a 5-category scale, from "minimal" to "exemplary", to examine self-assessed attitudes about use of weather to meet student needs, to teach science, to manage learning with Internet-delivered data, and to assist colleagues. The course increased the average of individuals' perceived category responses by 1.5 levels, from "rudimentary" to "adequate"/ "superior". Correct responses to science-content questions increased by an average of 19%, from 55% to 74%. Both the attitude and content increases were statistically significant at 95% levels (Weinbeck et al. 2002).

As shown in Figure 1 (following page), through the Spring 2002 term, 5850 teachers have been trained in the DataStreme Atmosphere course. Following the course they become weather education resource teachers in their school districts for their peers. A follow-up survey given to alumni at least one-semester after their enrollment indicated that each teacher had 20 interactions with colleagues and impacted 225 students. Thus, we can confidently state that course alumni teachers have so far impacted at least 120,000 additional teachers and over 1.5 million students. For more information, see: *http://www.ametsoc.org/dstreme/index.html*.

5. WATER IN THE EARTH SYSTEM

The success of DataStreme Atmosphere inspired the development of another teacher enhancement course, Water in the Earth System (WES), which focuses on the global water cycle as a vehicle to explore Earth system science. First offered in Spring 2001, WES utilizes the same delivery model as DataStreme Atmosphere (i.e., Local Implementation Teams, text and study guide, Internet delivery, several meetings with weekly mentoring). The WES course homepage provides a Weekly Water News file that is continually updated with water-related items from around the world, a supplemental water information file, the second half of twice-weekly learning investigations (delivered each Tuesday and Thursday during the term), and many site links on water topics.

WES semester evaluations and beginning/ending surveys follow the same format as DataStreme Atmosphere. Results show the same high participant satisfaction with the most positive response being 98% for the course overall, 98% for science content, and 95% for materials and Internet delivery. WES participants' confidence in the pedagogical utility of using water increased by 1.4 categories (same scale as DataStreme Atmosphere noted above). They also improved their content knowledge by 14%, also 95% statistically significant values (Geer et al. 2003).

Figure 2 shows that through the Spring 2002 semester, the WES course had trained 598 teachers. Course alumni are also acting as peer trainers on environmental data usage and water cycle understandings for their colleagues. The WES Project is expected to train over 1600 teachers by the conclusion of its NSF-funded period. For more information, see: *http://www.ametsoc.org/amsedu/WES/index.html*.

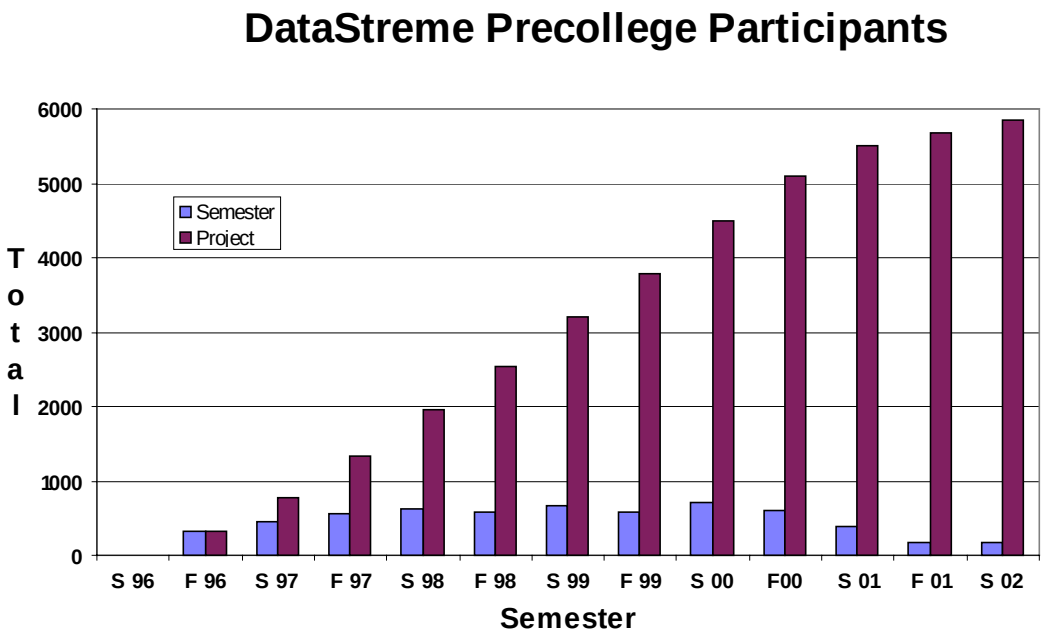

Figure 1. DataStreme Atmosphere precollege participant completions.

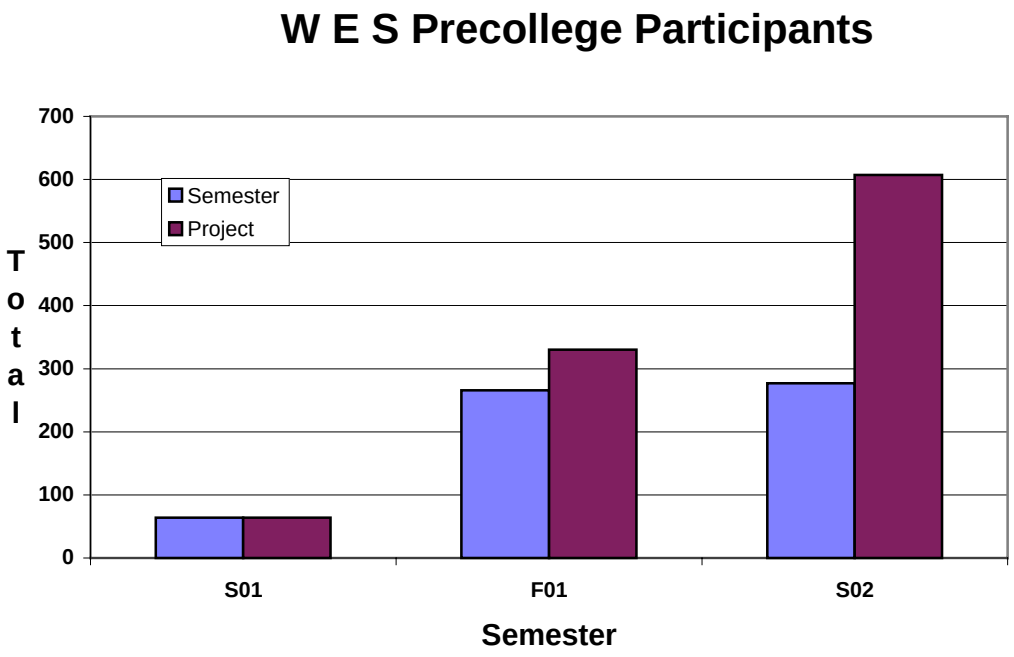

Figure 2. Water in the Earth System (WES) precollege participant completions.

6. ONLINE WEATHER STUDIES

Online Weather Studies is a turnkey, introductory college-level online distance-learning course about weather and climate. Developed from the DataStreme Atmosphere course, Online Weather Studies is made available to colleges and universities for local offering. Online Weather Studies has a custom-designed text, now in its all-color second edition, and student study guide containing the first halves of twice-weekly investigations utilizing near-realtime data. A secure course homepage provides a daily weather summary and frequent supplemental information files as well as the investigation conclusions and frequently updated custom meteorological products. Institutions may utilize the text, the study guide, or both in traditional or partially or totally online offerings. Faculty support through a secure faculty page, instructor's manual, and assessment materials is also provided. To date over 130 institutions nationwide have offered the Online Weather course (Geer et al. 2001).

The NSF through its Opportunities for Enhancing Diversity in the Geosciences (OEDG) and Course, Curriculum and Laboratory Improvement - National Dissemination (CCLI-ND) programs has funded an AMS effort to make Online Weather Studies more widely available to minority-serving institutions. The AMS Diversity Program's goal is to encourage enrollment in beginning science courses leading to greater numbers of minority students entering careers in the geosciences and science teaching. AMS provides enhanced faculty support for these offerings through a one-week summer workshop on course implementation at the NWSTC and a special session during the AMS Annual Meeting. Over four years, the program intends to introduce Online Weather Studies to 100 minority-serving institutions. For more information, see: *http://www.ametsoc.org/amsedu/online/info/index.html*.

7. AMS/NOAA CPESE

NOAA's long-term and strong support of AMS educational activity in the atmospheric and oceanic sciences and its partnerships in the Project ATMOSPHERE and Maury workshops, together with volunteer employee participation on DataStreme Atmosphere and WES LITs (more than 200), has led to the initiation of the Cooperative Program for Earth System Education (CPESE) by AMS.

NOAA is providing support to the AMS Education Program to (a) continue DataStreme Atmosphere beyond its NSF-funded phase, (b) to begin development of a DataStreme Ocean teacher enhancement distance-learning course, and (c) to encourage greater minority participation by training greater numbers of teachers who are members of groups underrepresented in the sciences and/or teach in schools with large minority student populations.

8. CONCLUSIONS

The AMS Education Program -- through Project ATMOSPHERE and its workshops and peer-training efforts, the Maury Project with its workshops and peer-training network, the DataStreme Atmosphere and WES courses developing thousands of resource teachers and peer-trainers, and Online Weather Studies with efforts to encourage increased study and interest in the geosciences at the introductory college level -- has offered thousands of teacher workshops nationwide on the fundamentals of meteorology, physical oceanography, and hydrology reaching over a million students at the K-13 grade levels. Master precollege teachers trained in the AMS Education Program have also been active in the implementation of the National Science Education Standards at their state levels, by writing local state frameworks and assessment materials. They have provided leadership that can be documented as impacting the teaching of science, mathematics and technology in almost 40 states.

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