

Consortium for Oceanographic Activities for Students and Teachers

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INTRODUCTION

The Consortium for Oceanographic Activities for Students and Teachers (COAST), funded by the Office of Naval Research as part of the National Oceanographic Partnership Program is a working collaborative designed to effectively deliver oceanographic and coastal processes education to K-12 teachers. Each of the three, COAST partners offers expertise in different areas and through focused efforts at specific educational levels using the broadest spectrum of methodologies and materials for ocean science education, as well as a nationwide telecommunications infrastructure. The COAST partners include: Operation Pathfinder, represented by The University of Southern Mississippi, the National Sea Grant College Program, 29 State Sea Grant College Programs, and the National Marine Educators Association, is a national inservice program for elementary and middle school teachers of predominantly minority students and the development of curricular materials; the Ocean Voyagers Program, represented by St. Norbert College, is a middle school teacher preservice training system featuring integrated curriculum development, World Wide Web page construction and maintenance, and teachers-to-sea experiences; and STARBOARD (Stimulating Teachers About Resources for Broad Oceanographic Research Delivery), represented by Mississippi State University, is a high school level effort combining training with teacher-student research partnerships to leverage computational science tools for ocean science research.

Each of these programs individually creates bridges between ongoing naval and academic research and formal and informal learning environments through focused precollege teacher education. Together, the COAST collaboration fuses the strengths of each partner to provide ocean science activities ranging from hands-on experiences aboard research vessels, through Web-based instruction, curriculum resources, and video-teleconferencing, to computational science and visualization of the highest quality. Each consortium partner is actively forging connections between research and the classroom in ways that all of the others may leverage and which may serve as national models. Operation Pathfinder provides hands-on experiences in marine research and empowers teachers to make these experiences relevant and exciting for their students. Ocean Voyagers works to place marine and ocean studies into a broad curricular context using, for example, literature, music, the arts, history, geography, or economics to provide teacher participants with personally meaningful points of access to oceanographic studies. STARBOARD transforms U.S. Navy unclassified data and NOAA data into visual representations of complex problems and conditions in ways which make those data engaging, understandable, and useful in local contexts. Each of these approaches makes oceanography and coastal processes science

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relevant in the lives of the teachers and their students and suggests the breadth and richness of careers in any of the math, science, and/or social science fields. A total of 22 “partners” are currently working together to ensure the success of this science education effort.

OBJECTIVES

The primary objectives of COAST are to:

- Increase the awareness and understanding of oceanography and coastal processes and to improve teaching techniques of “up to” 180 elementary, middle, and high school teachers of predominantly minority students each year of this two-year study.
- Incorporate the best of the best teacher-developed and field-tested activities relative to Oceanography and Coastal Resources Guide in “hard copy” and on CD-ROM, thereby “bridging the gap” between the research conducted by scientists and the interpretation and relevance of those data to precollege teachers and their students.
- Put “teachers-to-sea” aboard U.S. Navy ships depending on space availability so they can re-enforce the content knowledge gained in the 14-day Institutes offered in six regions of this country and its territories.
- Use “state of the art” multimedia technology for Web-page development and using U.S. Navy and NOAA data as 3-dimensional visualization tools in 3-D models and animation.

APPROACH

Elementary, middle, and high school inservice and preservice teachers were recruited through the Sea Grant network, the 17 chapters of the National Marine Educators Association, other Line Offices within NOAA, the National Science Teachers Association, state teachers organizations, professional societies, and through the U.S. Navy. Precollege teacher representation encompasses 29 states, the U.S. territories of Puerto Rico and various Pacific Islands. A national application was developed to be used in regional recruitment. Participants’ benefits within each of the six regional Institutes included:

- full graduate or undergraduate tuition
- a travel allotment
- three-semester credits
- room and board
- \$300 stipend
- resource materials

Participants’ commitments for being considered for selection:

- enrollment for a minimum of 14 days in residence at the host institution
- develop and implement at least one staff development program in his/her school district
- infuse oceanic and coastal processes concepts and activities within the curriculum
- conduct a professional presentation (article, paper, or workshop) at the state, regional, or national meeting

During the 14-day Institutes which were implemented in June and July of 1998, the regions and host institutions of higher learning were as listed:

Pacific-University of Washington and Washington Sea Grant College Program

Pacific Island Network-University of Hawaii and the Hawaii Sea Grant College Program

Great Lakes-University of Wisconsin and Wisconsin Sea Grant College Program

Northeast-Cornell University and the New York Sea Grant College Program

Mid-Atlantic-University of Delaware and the Delaware Sea Grant College Program

Gulf and South Atlantic-The University of Southern Mississippi and the Mississippi-Alabama Sea Grant College Program

The six content topics which were taught in each region encompassed:

- marine and aquatic habitats
- deep sea technologies
- marine and aquatic pollution
- physical parameters
- marine and aquatic resources
- plate tectonics

During 1998, a total of 123 scientists, educators, commercial fisher persons, the U.S. Navy, the U.S. Coast Guard, and/or social scientists provided content instruction and re-enforced the content with hands-on activities and/or multimedia presentations. The 1998 teachers also used for the first time the "best of the best" Oceanography and Coastal Processes Resource Guide which represented 79 of 1,410 activities which had been developed and field-tested by former Operation Pathfinder Participants during 1993-1997. Recruitment for 1998 resulted in 133 teacher participants. Based on percentages, there were 65 percent of the total number represented by females and 35 percent by males. There was a near average distribution between elementary, middle, and high school teachers. Ethnicity distribution varied from Caucasin, Asian, Native American, African American, and Hispanic.

Teachers were involved in at least three days of field trips within each region. These field experiences varied from being aboard research vessels obtaining vertebrate and invertebrate class collections; to hiking in maritime forests for plant identification and classroom collections; to conducting geological surveys for sediment and rock types; to taking physical parameters of pH, dissolved oxygen, temperature, salinity, and turbidity; to canoeing from fresh to saline waters; to boarding planes for aerial "fly-overs" to observe long shore currents; to hiking along various shorelines; to visiting aquaculture, marine mammal, and/or incineration facilities; to visiting national parks, marine estuarine reserves, and/or man-made estuaries.

The Ocean Voyagers' sessions within each of five Institutes (exception: Pacific Island Network) were focused on the development and implementation of integrated curriculum directed at marine science by providing participants with examples in literature, i.e., Carry on Mr. Bowditch and Timothy of the Cay, history, and geography. The Ocean Voyager team also provided basic web navigation instruction and an introduction in the use of computer technology as a resource for developing ocean-related curricula. The five preservice teachers enrolled within five of the six regions were also provided by the Ocean Voyagers team.

ACCOMPLISHMENTS

All Operation Pathfinder participants received grades based on staff development presentations, homework presentations, one essay exam, a journal, and participation. All grades were A's and B's. Pre-and posttests were also administered to each participant using a t-test. Each region, at the .05 level indicated significance in comparison of the pre- to the posttest results. A Likert-scale attitudinal evaluation was also administered to each participant in each region. The scale ranged from Very Valuable, to Valuable, to Average Value, to Limited Value, to Very Limited Value. All participating teachers rated the six content areas, the presenters, and the field-trips between 79-97 percent Very Valuable/Valuable and their perceptions at the Average/Limited Value varied from 3 to 21 percent.

When adding the 133 regional 1998 Operation Pathfinder participants to those teachers involved in these Institutes since 1993, there are 549 alumni. The "multiplier effect" of these teachers teaching an additional 20 teachers in their respective staff development programs translates into an additional 11,000 precollege teachers. These 11,549 teachers have the potential of reaching 4.2 million precollege teachers over a five-year teaching career.

Each of the three COAST components have Web addresses which are as listed below:

Operation Pathfinder's homepage is <http://ims.usm.edu/~jlscott>

Ocean Voyagers' homepage is <http://voyager.snc.edu>

STARBOARD's homepage is <http://www.coast.nopp.org/starbord>

The COAST homepage is <http://www.coast-nopp.org>

The Ocean Voyager team planned, recruited participants for, and conducted a five-day "Shakedown Cruise" workshop for 20 teachers, informal educators, and naval personnel from Mississippi, Texas, Virginia, Wisconsin, and Washington, D.C. in June 1997. The workshop included formal presentations of teaching activities focusing on oceanographic and integrative curriculum content, the development of program strategies, and the formation of long-term school partnerships with Ocean Voyagers. This preliminary academy aimed to introduce a small, select group of educators to the goals and objectives of Ocean Voyagers. Its purpose was to inspire teachers to launch integrated curricula that would focus on oceanographic and marine science studies in the classroom. The Shakedown Cruise participants developed personalized instructional plans for future implementation in their schools in partnership with other Shakedown Cruise participants and the Ocean Voyagers' program staff.

In the spring, summer, and fall of 1998, twenty-nine precollege teachers were carefully selected, primarily from former Operation Pathfinder Institutes, and sailed on U.S. Navy oceanographic survey ships in the Atlantic Ocean, the Mediterranean Sea, and in the Gulf of Mexico for periods of four to 10 days. Six high school students (five were winners of the National Ocean Sciences Bowl and one represented the Navy's State Science Fair Finalist in Mississippi for having the "best" oceanographic/meteorology project) also had the opportunity to experience this adventure during the summer Sea Scholars/Project Marco Polo adventure. The USNS Henson and/or Pathfinder were the ships used in celebrating "The Year of The Ocean."

The STARBORD component met with Navy and NOAA personnel to review data resource availability related to the content areas being taught in the Operation Pathfinder Institutes. Six data sets were obtained. Based on these data sets, application development has been focused primarily on an ocean data translator, an ocean current simulator, and a watershed experimentation tool. Participating teachers in each regional Institute have been able to use these virtual interpretations to define the coordinates of latitude and longitude, ocean currents, earth texture maps, and watersheds. Currently, the STARBORD team has developed several modules for their Web site which have initially been placed in two major categories: Physical and Chemical Parameters and Processes and Biota and Biotic Processes. These two categories have been further divided in the following topic areas:

- mapping and analytical systems, including projection systems and charting and navigation;
- basin and coastal morphology, including principal features;
- classification systems, including taxonomic and evolutionary adaptations—using dolphins as an example.

Additionally, the STARBORD team was involved in mini-workshops within each Institute and conducted sessions which allowed interaction with the participants as they implemented their visualization tools, 3-D objects, video and image capturing, digital imaging, presentation software, Web-page design, and an introduction to grant writing. Informal evaluations were administered to each participant in five of the six regions (exception: Pacific Island Network) and the results revealed an overwhelming enthusiasm about the teachers' use of visualization and other forms of electronic technology within their respective classrooms.

Presentations of COAST have been made at the following national and regional conferences or meetings (note: this listing is incomplete at this time):

- April 1998, National Science Teachers Association, Las Vegas, Nevada
- August 1998, National Marine Educators Association, San Juan, Puerto
- October 1998, Mississippi Science Teachers Association
- November 1998, Marine Technology Society, Baltimore, Maryland
- December 1998, Southern Association of Marine Laboratories, Biloxi, Mississippi
- December 1998, NOPP Education Meeting within the American Geophysical Union Conference, San Francisco, California;

As a last accomplishment, the Likert-scale evaluations administered to all participants revealed enthusiastic positivism as previously stated; however, relative to advances in technology, it was determined that no one area of the country seemed to be ahead of another in its integration; the variance in our country is by school or school district rather than by geographic region. All personnel involved in the implementation of COAST were favorably impressed with the caliber of teachers in this country which speaks well of its overall educational system.

Nineteen additional teachers from the Pacific Island Network have been recruited for an abridged Institute in January 1999, therefore, the official total participant number for 1998 will officially be 152 teachers.

Problems Encountered

The following list represents three major problem areas encountered throughout all six regional Institutes (it should be noted the first two areas are “fixable” and the third area will require additional time for precollege change within this country):

- Recruitment of teachers to “fill” classes of 30 within each region has not occurred as well as anticipated. Part of this situation resulted from two to four teachers canceling their participation within an Institute, too late for additional recruitment. Each 1999 regional coordinator for Operation Pathfinder is aware he/she needs to maintain a “waiting list” of teachers;
- Subcontracts to the six, regional Operation Pathfinder host universities did not occur as smoothly as it should have as a result of too few personnel within the Office of Research and Sponsored Programs within the University of Southern Mississippi and some regional coordinators for Operation Pathfinder did not submit their budgets in as timely a manner as they should have (this also hindered adequate recruitment of teachers); and
- From the technology component for implementation within all six Institutes, the lack of state and federal educational funding for initial equipment purchases and ongoing support for technology in public and private schools within this country and its territories; this national area of concern “spills over” to the need for the integration of technological support/resource staff within the precollege infrastructure; and consistent support and advocacy by precollege administration and teachers for change attributed to technology and its implementation is too often too slow and in some cases completely absent.

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IMPACT/APPLICATION

In closing, COAST's three implementation teams, i.e., Operation Pathfinder, Ocean Voyagers Program, and STARBOARD, are of the opinion the following excerpt from Oceans 2000: Bridging the Millennia, Partnerships for Stakeholders in the Oceans from CORE, 1996 is being successfully achieved:

- Partnership between oceanographers and educators with current perspectives on learning are necessary. There are reciprocal benefits between the two cultures, oceanography and education. The former focuses on generating new knowledge about oceans. The latter focuses on tying pieces of information into a whole picture that can be made relevant to other scientists and to non-scientists. Together they can develop new courses.
- A partnership is necessary since educating and training teachers is a continuous effort. Children represent our future and investing in them through teacher training programs is a “win-win” situation for all the partners involved. The continuous partnership ensures the delivery of timely research findings into the classroom.