DOCUMENT RESUME

ED 395 824 SE 058 492

TITLE	Instructional Materials Development, Fiscal Years 1991-1994. Summary of Awards.
INSTITUTION	National Science Foundation, Arlington, VA. Directorate for Education and Human Resources.
REPORT NO	NSF-95-123
PUB DATE	95
NOTE	85p.; Replaces NSF-91-96.
AVAILABLE FROM	National Science Foundation, Directorate for Education and Human Resources, 4201 Wilson Blvd., Arlington, VA 22230.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	Elementary Secondary Education; Grants; *Innovation; *Instructional Materials; *Mathematics Education; *Science Education; *Technology Education
IDENTIFIERS	*National Science Foundation

ABSTRACT

The Instructional Materials Development (IMD) projects are designed to facilitate changes in the delivery of classroom instruction by developing and implementing investigative, hands-on science, mathematics, and technology education curricula. The program supports materials that are aligned with curriculum standards that enable all students, regardless of background or ability, to acquire sophisticated content knowledge, higher order thinking abilities, and problem-solving skills. The grants described in this document are the awards in the IMD Program made by the Education and Human Resources Directorate of the National Science Foundation (NSF) during fiscal years 1991-1994. Grants are cataloged into sections by content--mathematics and science--and by grade level--elementary, middle, and high school. Grants that are primarily assessment are listed in a separate section as are proposals for conferences and studies. (JRH)

SUMMARY OF AWARDS

INSTRUCTIONAL MATERIALS DEVELOPMENT
FISCAL YEARS 1991–1994

Division of Elementary, Secondary, and
Informal Education
Directorate for Education and Human Resources

NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) provides awards for research, development, and educational activities in sciences, mathematics, and engineering. The Foundation has a particular interest in furthering the quality of human resources in these areas. The awardee is wholly responsible for the conduct of such activity and preparation of the results for publication. The Foundation, therefore, does not assume responsibility for such findings or their interpretation.

The Foundation welcomes proposals on behalf of all qualified scientists, engineers, and educators and strongly encourages women, minorities, and persons with disabilities to compete fully in any of the research and research-related programs described in this document.

In accordance with Federal statutes and regulations and with NSF policies, no person on the grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from the Foundation.

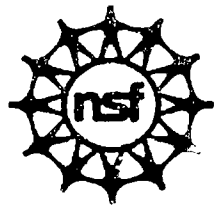
Facilitation Awards for Scientists and Engineers with Disabilities (NSF-91-54) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on an NSF project. Contact the Facilitation Awards Coordinator in the Directorate for Education and Human Resources. The telephone number is (703) 306-1620.

The Foundation has TDD (Telephonic Device for the Deaf) capability, which enables individuals with hearing impairments to communicate with the Division of Personnel and Management about NSF programs, employment, or general information. The telephone number is (703) 306-0090.

This program is described in the Catalog of Federal Domestic Assistance number 47.076, Education and Human Resources.

SUMMARY OF AWARDS

Instructional Materials Development
Fiscal Years 1991–1994



Division of Elementary, Secondary, and Informal Education

NATIONAL SCIENCE FOUNDATION 1995

CONTENTS

Instructional Materials Development

The grants described in this document are the awards in the Instructional Materials Development (IMD) Program made by the Education and Human Resources Directorate of the National Science Foundation (NSF) during fiscal years 1991 through 1994.

Grants are cataloged into sections by content—mathematics and science—and by grade level—elementary, middle, and high school. Where a project is useful in more than one category, the abstract is repeated. Grants that are primarily "Assessment" are listed in a separate section as are proposals for "Conferences and Studies." Grants addressing "Technology Education" are not separate, but a separate listing of these grants may be found in the index. Award amounts as shown are the total granted, although several grants are funded jointly with other NSF Divisions.

IMD projects are designed to facilitate changes in the delivery of classroom instruction by developing and implementing investigative, hands-on science, mathematics, and technology education curricula. The Program supports materials that are aligned with curriculum standards that enable all students, regardless of background or ability, to acquire sophisticated content knowledge, higher order thinking abilities, and problem-solving skills. The materials should also support teachers as they change their practice in accordance with the standards.

Information about the grants in this document can also be found on the NSF Instructional Resource Line (NIRL) via Telnet (nirl.qrc.com) or Internet (http://www.qrc.com/develop/nirl) or on the Science and Technology Information System (STIS) via electronic mail (stisserv@nsf.gov).

Program Goals

The IMD Program supports a variety of projects; the cumulative effect of these projects over the next several years will lead to significant positive changes in mathematics, science, and technology education:

- Multiyear and single-year comprehensive curricula, individual modules, and supplemental materials that develop challenging content and demonstrate connections between disciplines and applications to real-world experiences while maintaining accurate content.
- Materials that engage students from diverse populations, especially those from underrepresented groups, and reflect sensitivity to gender, social, and cultural issues, as well as meet the needs of those who are specially challenged.
- Projects that demonstrate a proactive plan for dissemination and implementation of quality materials that incorporate new instructional strategies and content.

Instructional materials influence what students are taught and how teachers teach; therefore, an innovative, comprehensive, and diverse portfolio of instructional materials which implements standards-based reform in mathematics, the natural and social sciences, and technology education from early childhood to 12th grade and beyond is required.

The Program accepts unsolicited proposals that respond to its general goals and priorities; funding decisions are made after an extensive peer-review process. From time to time, special program solicitations call for proposals that address specific high-priority needs.

We appreciate the considerable expertise and good judgment brought to the recommendation for funding of these proposals by the review panels consisting of teachers, supervisors, and educators, as well as practicing scientists, mathematicians, and technologists. We also acknowledge the input and discussions concerning these proposals with former program officers: Joseph Adney, Margaret Cozzens (now Division Director of the Elementary, Secondary, and Informal Education Division), Colleen Hill, Donald Humphreys, Chris Hirsch, Toni Kring, Ivo Lindauer, Alice Moses, Eric Robinson, James Sandefur, and Frank Sutman.

Program Officers
Instructional Materials Development Program
National Science Foundation
Room 885
4201 Wilson Boulevard
Arlington, VA 22230
(703) 306-1620

John Bradley
Karen Lind
Franzie Loepp
M. Patricia Morse
Emma Owens
Gerhard Salinger

Elementary Science

Charles G. Groat
American Geological Institute (AGI)
4220 King Street
Alexandria, VA 22302
(703) 379-2480

9353035
$808,282
Start: 9/15/94
(30 months)

AGI K–6 *Earth Science Sourcebook* and Mentor Program

AGI is developing 10 to 12 units of instructional materials for an *Earth Science Sourcebook* for elementary school. These supplemental curriculum materials are for grades 4–6 ar focus on topics which include the atmosphere, the biosphere, the hydrosphere, and the lithosphere. The materials include hands-on inquiry-based classroom activities, transparency masters, charts, graphs, maps, a resource catalog, assessment strategies, and teacher guides. Because they were designed by a team of elementary school teachers, earth scientists, science educators, and assessment specialists, these materials are designed to achieve science-education goals.

Descriptors: Assessment, Atmosphere, Biosphere, Book, Elementary School, Hands-On Activities, Hydrosphere, Lithosphere, Mentoring, Student Activities, Supplemental, Teacher Materials

---

Alan Rossman
Chicago Horticulture Society
P.O. Box 400
1000 Lake Look Road
Chicago, IL 60603
(708) 835-8224

9350513
$934,596
Start: 10/1/93
(42 months)

Establishing Public Garden/School Partnerships for Improved Science Education

The Midwest Public Garden Collaborative, a consortium of five public gardens and arboreta recognized for their leadership and contributions in public science education, seeks support to develop a series of instructional materials entitled Discovery Units. These units will link classrooms to public gardens with investigations and study that will occur before, during, and after a public garden field trip. Field trips will be planned as an integral part of the overall science instruction program. This cooperative partnership project has the potential of reaching 100,000 elementary students and 4,000 of their teachers each year.

Descriptors: Elementary School, Life Sciences, Partnership, Units

---

Joel Schneider
Children's Television Workshop
One Lincoln Plaza
New York, NY 10023
(212) 595-3456

9353025
$1,837,950
Start: 5/15/94
(29 months)

"Square-One TV" School-Use Project

In this project, the Children's Television Workshop will develop innovative instructional materials based on its "Square-One TV" television series to supplement mathematics curricula for the 4th, 5th, and 6th grades. The project will develop 20 instructional modules of single-topic television programs and videos for use in the classroom as well as teacher enhancement videotapes and print packages and a teacher-parent video. Each video will be approximately 15 minutes long. The classroom materials will present sound mathematical content in an interesting, accessible, and meaningful manner that encourages the use of problem-solving processes and promotes positivity toward and enthusiasm for mathematics. Field testing and evaluation of the materials will be included in the project. Partnerships with PBS and the NETWORK will contribute to the dissemination of the materials.

Descriptors: Elementary School, Mathematics, Middle School, Parents, Problem Solving, Supplemental, Teacher Enhancement, Teachers, Television Programs, Videotape

---

James Perkins
CSY, Inc.
111 East Capital Street, Suite 365
Jackson, MS 39201
(601) 352-0477

9154130
$775,228
Start: 8/1/92
(36 months)

Minorities in Science Series

CSY, Inc., and the Science and Engineering Alliance are working collaboratively to develop a multimedia-based Minorities in Science Series for grades K–8. A set of eight modules (each of which has at its core an interactive multimedia component) is produced. Each module provides teachers with an overall plan to help them to orchestrate the set of activities in the module and to integrate the module into their curricula or other learning contexts. The project plans to produce one version of the modules for grades 3–5 and another for grades 6–8. A third version, consisting of videotaped presentations and hands-on activities, is created for grades K–2. The materials are designed to provide a solid foundation for understanding scientific and technological concepts and how they relate to students' personal and social context. The goal is to create courseware that provides technology-based pedagogical strategies, increases minority achievement, stresses minority role models, and brings an overall sense of pride and ownership to the learning process on the part of minority students.

Descriptors: Careers, Computer Simulations, Earth Sciences, Elementary School, Engineering, Hands-On Activities, Middle School, Minorities, Modules, Multimedia, Physical Sciences, Science, Student Activities, Supplemental, Teacher Materials, Teaching Strategies, Technology Education, Urban School, Videotape

---

Laurel Robertson
Sheila Regan (Co PI)
Developmental Studies Center
2000 Embarcadero Drive
Oakland, CA 94606
(510) 533-0213

9150104
$1,184,146
Start: 8/1/91
(48 months)

Cooperative Mathematics Project: Developing Number Sense Through Problem Solving

This project develops a program for kindergarten through 6th grades. The program fosters the development of number-sense concepts

through a problem-solving approach; provides conceptual experiences that promote students' understanding of number, quantity, and operations; and incorporates new teaching strategies and content for elementary mathematics instruction. The project also pilots and evaluates three units in each grade level.

Each unit is 2 to 3 weeks long and has a dual focus: to deepen students' understanding of mathematical concepts and to develop interpersonal skills and commitment to values of caring, fairness, and responsibility. The units provide opportunities for students to explore number concepts as they cooperatively investigate problems and communicate about their thinking and learning. The units are developed through a process that includes repeated trials in classrooms by teachers and CMP staff. The units are published by Addison-Wesley.

An evaluation assesses (1) how teachers use the materials in their classrooms, (2) how participation in a staff-development program influences teacher implementation, and (3) what impact the program has on student concept attainment and teachers' and students' attitudes about mathematics.

Descriptors: Assessment, Communication Skills, Conceptual Learning, Elementary School, Mathematics, Number Sense, Problem Solving, Units

Ronald D. Todd
Drexel University
32nd and Chestnut Street
Philadelphia, PA 19104
(215) 895-2000

9154125
$998,568
Start: 4/15/92
(36 months)

Project UPDATE (Upgrading Practice through Design and Technology/Engineering Education)

This project develops 12 K–8 curriculum packages for teaching integrative mathematics, science, and technology. The materials focus on design, technology, and problem-solving approaches. They can also be used as models for innovative instruction and further curriculum development efforts of teachers and professionals from science, mathematics, engineering, design, and technology. A teacher-enhancement program is initiated regionally through participating teacher-training institutions. National dissemination of the models and materials is accomplished primarily through *TIES Magazine*—a free periodical published by Drexel University for teachers. The curriculum materials support a national commitment to improve education in mathematics, science, and technology by reconstructing what professionals have learned as they continue to put their knowledge to work.

Descriptors: Elementary School, In-Service Training, Integrated Curricula, Mathematics, Middle School, Multidisciplinary, Problem Solving, Science, Supplemental, Teacher Enhancement, Technology Education

Barbara Sprung
Educational Equity Concepts, Inc
114 E. 32nd Street, Suite 701
New York, NY 10016
(212) 725-1803

9252987
$722,769
Start: 9/1/92
(36 months)

Playtime Is Science: A National Model for Parent Involvement in Early Science Education

This project is designed to enlarge the potential pool of students who are competent in science and technology to include more girls, children of color, students with disabilities, and children from low-income families. By engaging parents in partnership with schools and community organizations, this program increases the science literacy of young children (ages 4–7) as well as that of their parents and other adults in their lives.

This 3-year project, built on a successful local model developed in New York City public schools, offers the following activities: training and networking for site liaisons; pilot-testing and evaluation at three sites chosen for geographic, racial, ethic, language, and socioeconomic diversity; materials development and production; a formal research study; and intensive national dissemination of Playtime Is Science materials package. Materials to be developed include (1) four videotapes to provide a visual rendering of the program for parents, teachers, and administrators; (2) a how-to manual providing easy-to-follow instructions for implementing the program; and (3) a home activity booklet for parents illustrating science activities that use inexpensive, readily available materials found in every home.

Descriptors: Careers, Disabilities, Elementary School, Female, Minorities, Parents, Prekindergarten, Science, Student Activities, Supplemental, Take-Home Materials, Teacher Materials, Technology, Videotape

Norman Avrech
Lawrence F. Lowery (Co-PI)
Galaxy Institute for Education
200 North Sepulveda Boulevard
El Segundo, CA 90245
(310) 364-6873

9154106
$4,023,000 + $150,000
Start: 6/1/92
(36 months)

Galaxy Classroom

This 3-year project develops a systematic program for educationally at-risk elementary students. The program strengthens curriculum through the development of video-based supplementary educational materials distributed via a dedicated satellite interactive network. The program focuses on integrated classroom activities and strong enhancement program for teachers, administrators, and parents. It aims to motivate children by (1) promoting positive attitudes toward learning, (2) encouraging personal responsibility and positive self esteem, and (3) teaching skills necessary for living in our dynamic society. The project includes two 13-part science video programs (closed captioned, Spanish track) for grades K–2 and 3–5 and comparable programs for English-language arts. It will reach 37 representative urban and rural elementary schools (and one in Mexico). The project includes hands-on science curriculum materials and substantial formative and independent summative evaluations.

Descriptors: At-Risk Students, Closed Captioned, Earth Sciences, Elementary School, Hands-On Activities, Hearing Impaired, In-Service Training, Integrated Activities, Kits, Language, Life Sciences, Minorities, Parents, Physical Sciences, Science, Spanish, Student Activities, Supplemental, Teachers, Videotape

Phyllis Katz
Janet Frekko (Co-PI)
Hands-On Science Outreach (HOSO), Inc
4910 Macon Road
Rockville, MD 20852
(301) 881-1142

9054641
$109,305
Start: 1/1/91
(30 months)

MATHSTART: A Year's Units for Head Start Four-Year-Olds

This multidisciplinary project matches the "at-risk" population of Head Start and its staff with the expertise of the HOSO program in producing units of lesson guides, manipulative kits, and teacher enhancement. Working with mathematics consultants, the developers designed three units (fall, winter, and spring) around the concepts of Numeration, Chance, and Geometry. The activities are multicultural and multisensory, they focus on toys and games that children can take home, and they take into consideration the development of both large- and small-motor skills. Parent information is available in English, Spanish, and Vietnamese, with a visual videotape component and meetings planned into the project. These components, developed in consultation with mathematicians, help motivate home continuity by relating mathematics concepts to everyday activities. The MATHSTART units are piloted, evaluated, and refined in five demographically different Head Start programs in Maryland. After refinement, further dissemination occurs through both the Head Start and HOSO networks.

Descriptors: At-Risk Students, Kits, Minorities, Multicultural, Multidisciplinary, Parents, Prekindergarten, Spanish, Take-Home Materials, Units, Videotape, Vietnamese

Phillip Sadler
Bruce Ward (Co-PI)
Harvard University
Holyoke Center 458
Cambridge, MA 02138
(617) 495-1000

9154113
$1,471,973
Start: 5/15/92
(36 months)

Project Aries: Astronomy Resources for Intercurricular Elementary Science

Using astronomy as the central focus, this project produces a modular, hands-on, discovery-based, intercurricular, multicultural physical science program for elementary students. At least half of the pilot classrooms are in settings where underserved minorities constitute a major portion of the student population. The modules are the initial components of a complete program which may serve as a basic physical science curriculum or as a complement to an existing course. Teacher-enhancement videotapes are developed by the CFA's Science Media Group, featuring exemplary classroom teaching along with scientific background to the activities.

Descriptors: Astronomy, Elementary School, Hands-On Activities, Minorities, Modules, Multicultural, Physical Sciences, Science, Supplemental, Teacher Enhancement, Videotape

Kathleen Hogan
Alan R. Berkowitz (Co-PI)

9054634
$524,239

New York Botanical Garden
Institute of Ecosystem Studies
Box AB
Millbrook, NY 12545-0129
(914) 667-5976

Start: 2/8/91
(24 months)

Eco-Inquiry: An Ecology Curriculum for Grades 5–6

The Institute of Ecosystem Studies produces, tests, and disseminates an ecology curriculum entitled "Eco-Inquiry." The foundation of this multidimensional, 8- to 15-week, 5th and 6th grade curriculum has been built through 4 years of local development and testing. The content of the modules includes exploration of food webs, decomposition, nutrient cycling, and the application to a local environmental issue. The materials also include assessment tools, concept-mapping guidelines, and a guide to food-web clues in schoolyard habitats. Eco-Inquiry has three distinctive features: (1) its emphasis on the conceptual underpinnings of ecological literacy, (2) its commitment to modeling the practice of science and scientists, and (3) its approach to developing students' inquiry skills and dispositions through modeling the scientific community in the classroom. Eco-Inquiry uses a diversity of teaching methods (e.g., collaborative learning, teaching for conceptual change) to engage students in activities that are imaginative and highly participatory.

Descriptors: Conceptual Learning, Cooperative Learning, Ecology, Elementary School, Hands-On Activities, Middle School, Science Inquiry, Student Activities

Michael S. Isaacson
Patricia G. Calarco (Co-PI)
Microscopy Society of America
P.O. Box MSA
204 Woods Hole Road
Woods Hole, MA 02543
(607) 255-4302

9355777
$15,000
Start: 9/15/93
(14 months)

Project MICRO: Microscopy in Curriculum—Research Outreach

This project is to do the research and development necessary to prepare trial instructional materials on microscopy and microscopes, how they work, and how they are used to answer questions in different fields of science in K–12 schools. The intent of this proposal is to develop a preliminary teaching guide and kit (a test module) that will provide an integrated constructivist approach to science learning by using the microscope to acquire knowledge in life, earth, and physical sciences. The materials will be developed in collaboration with the Lawrence Hall of Science in Berkeley, California. A unique opportunity is available to test the materials with the Excellence in Teaching Elementary Science (EXCITES) Program within a National Science Foundation funded project to be held at the University of California at Davis during the summer of 1993. The project includes a follow-up fall workshop for revisions and additional development, with continued participation and testing by the EXCITES teachers in the summers of 1994 and 1995. This phase of the project will culminate with a curriculum guide, which has been tested for 3 years and is ready for national distribution.

Descriptors: Constructivist Approach, Elementary School, High School, Kits, Microscopy, Middle School

Gary E. Dwoskin
National Academy of Sciences
National Science Resources Center
2101 Constitution Avenue, NW
Washington, DC 20418

9252947
$2,227,450
Start: 7/1/92
(18 months)

Science and Technology for Children

The Science and Technology for Children (STC) program consists of 24 8-week curriculum units (four at each grade level, 1–6) that actively involve children in hands-on, inquiry-centered investigations of scientific phenomena. Using discovery, reflection, and applications, the STC units provide children with the opportunity to learn developmentally appropriate concepts central to the life, earth, and physical sciences, and technology. Simultaneously, children develop critical thinking and problem-solving skills. STC units provide teachers with a variety of strategies with which to assess student learning, as well as opportunities to link the teaching of science with other areas of elementary school curriculum, including mathematics, language arts and social studies. In addition, the STC units encourage the use of cooperative learning to help students to work effectively as a team. To ensure that the STC units are scientifically accurate and pedagogically appropriate for children and teachers from diverse ethnic and racial groups, they are developed by a staff of teachers, scientists, and educators with a broad diversity of experience in elementary science education; nationally field tested in classrooms of ethnically diverse groups of children and teachers from urban, rural, and suburban school districts; and reviewed by an advisory panel of prominent scientists and educators. The STC project is directed by the National Science Resources Center, which is operated jointly by the National Academy of Sciences and the Smithsonian Institution.

Descriptors: Conceptual Learning, Cooperative Learning, Elementary School, Hands-On Activities, Inquiry Learning, Language Arts, Science, Social Sciences, Supplemental, Technology, Units

Harriett S. Stubbs
Steven Businger, Walter Heck (Co-PIs)
North Carolina State University
Air Resources Research Consortium
1509 Varsity Drive
Raleigh, NC 27606
(919) 515-3311

9150001
$1,393,738
Start: 5/15/91
(48 months)

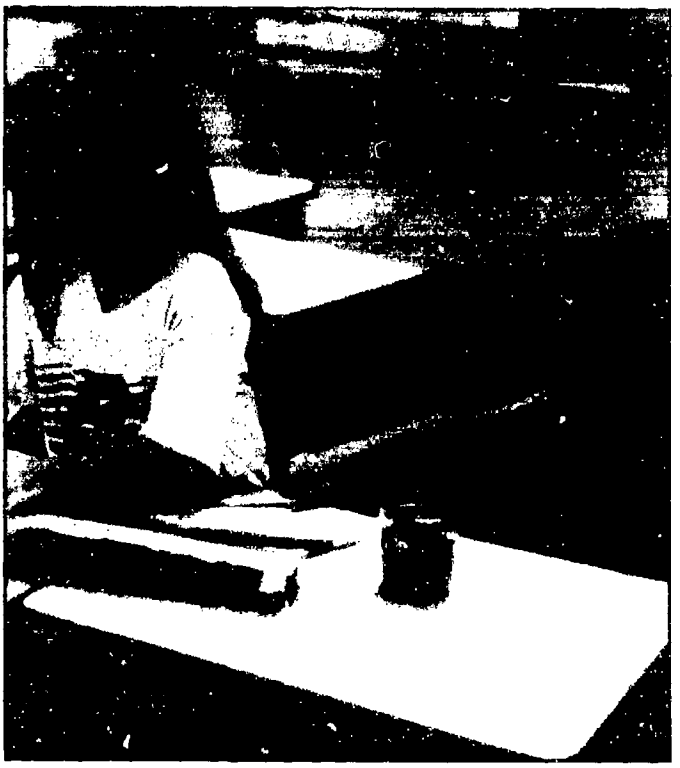
GLOBE-NET: Changes in the Global Environment

New instructional materials that incorporate scientific research on global environment changes are developed for grades 4–12, to be infused into ongoing curricula. The program capitalizes on 10 years experience in the development, publication, and dissemination of materials on air-quality issues and the network already established between scientists, educators, teachers, and students. GLOBE-NET creates, evaluates, and prepares materials that are bias-free and scientifically and educationally sound. These materials take into account findings of research scientists in content areas and current research on how students learn science.

These materials are designed to be infused into existing and established courses of study in life, earth, physical, environmental sciences—in biology, chemistry, physics, and other science curricula. Thirty units are developed on topics including acid rain, global warming, atmospheric pollution, and ozone depletion, as each relates to scientific concepts in biodiversity, microbial respiration, physics, chemistry, and meteorology. By dealing with global environmental changes, these materials provide hands-on experiences, cooperative and inquiry learning, and other research-based strategies. The materials are to be published by Carolina Academic Press and disseminated by Carolina Biological Supply Company and others.

This project translates and transfers the most current information on this vital topic to teachers, to students, and ultimately to the general public. GLOBE-NET helps teachers, students, and parents learn more about science and is intended to help create an informed citizenry that is cognizant of scientific issues of major international concern. Cooperation between science education and the various science departments at North Carolina State University and science education at the University of Minnesota provides the expertise and breadth necessary for the project.

Descriptors: Biodiversity, Che... .y, Cooperative Learning, Elementary School, Global Change, Hands-On Activities, High School, Inquiry Learning, Interdisciplinary, Meteorology, Microbial Respiration, Middle School, Modules, Multidisciplinary, Parents, Physics, Research, Science



Tom Alcoze
Northern Arizona University
Box 4132
Flagstaff, AZ 86011
(602) 523-9011

9353217
$1,107,077
Start: 9/1/93
(48 months)

Native Science Connections

The proposed Native Science Connections project is designed to develop culturally relevant science modules that complement the existing science curricula in grades 4–6. The curricular materials in science and mathematics will focus on four Native American tribal nations: Zuni, Hopi, Apache, and Dine (Navajo) and will demonstrate the existence and validity of Native American sciences and mathematics as they are manifested within the traditions and cultures of the original peoples of the Americas. The project will be directed and developed by experienced Native American science teachers and education professionals. Materials produced from this project include four science modules that will be developed around environmental themes. They will be used in both Native American and mainstream classrooms.

Descriptors: Environmental Themes, Mathematics, Middle School, Modules, Native American Culture, Science

John Kelly
Recording for the Blind
20 Roszel Road
Princeton, NJ 08540

9252918
$289,115
Start: 7/1/93
(36 months)

Access to Science Materials for Print-Disabled Students

A Comprehensive Listing System is created to increase the amount of mathematics and science materials available in alternate formats including braille, large print, recorded, and electronic form in Canada and the United States for blind and print-disabled students in grades 3–14. Four major organizations serving print-disabled persons in North America are adding their bibliographic information to both the APH-CARL and UNION national databases, major databases serving Library of Congress users and institutions serving the visual-impaired and print-disabled. The collaborative also invites more than 400 small publishers and colleges with Disabled Student Services (DSS) Offices on their campuses to contribute other titles not presently included on the database. Materials are available in several languages to accommodate users' needs. As a part of this project, Recording for the Blind (RFB) provides training to DSS offices on RFB standards for recording science and mathematics materials to ensure uniform quality. They also train users, educators, and librarians on the new systems to increase use and minimize problems associated with the transition to college by print-disabled students.

Descriptors: Braille, Databases, Elementary School, High School, Language, Mathematics, Middle School, Postsecondary, Print-Disabled Students, Science, Visually Impaired

Alan McCormack
San Diego State University Foundation
Department of Science Education
San Diego, CA 92182
(619) 594-6123

9252989
$1,053,663
Start: 3/15/93
(36 months)

VISTA: Visual Spatial Thinking Activities

Project VISTA (Visual Spatial Thinking Activities) is a curriculum development/research project designed to produce a bank of enrichment/enhancement science-oriented visual spatial thinking (VST) learning activities for grades K–8. University science educators, scientists, cognitive psychologists, and educational technologists will collaborate with 36 exemplary teacher associates to develop and refine Project VISTA activities over a phased 3-year period. The project is to produce the following outcomes: (1) a baseline of assessed VST abilities for children in grades K–8, (2) a battery of new VST assessment instruments, and (3) a large collection of innovative VST science learning activities, including hands-on experiences, interactive videotape-based experiences, computer-based experiences, and inquiring demonstrations. These enrichment materials will be made available nationally to build upon and supplement all existing K–8 science programs.

Descriptors: Assessment, Computer Sciences, Earth Sciences, Elementary School, Female, Hands-On Activities, Life Sciences, Middle School, Minorities, Physical Sciences, Science, Student Activities, Videotape

Jill Tarter
David H. Milne, Kathleen O'Sullivan (Co-PIs)
Search for Extraterrestrial Intelligence
(SETI) Institute
2035 Landings Drive
Mountain View, CA 94043
(415) 961-6633

9150120
$659,723
Start: 7/1/91
(36 months)

Life in the Universe: An Exciting Vehicle for Teaching Integrated Science

This project develops six guides for teachers: three for elementary and three for middle school grades. Each guide contains approximately 10 hands-on science activities, suitable for 10 to 12 weeks of study. The activities present many science and some nonscience disciplines that are naturally linked and integrated by a single research discipline: SETI—"Search for Extraterrestrial Intelligence."

The activities in each guide begin with a look at the Earth, solar system, and universe, then examine questions about life on Earth. The segments end with questions and imaginative constructs on the possibility of life elsewhere in the universe. In so doing, they present biology, earth science, physical science, and other standard classroom sciences from the fresh perspective of their possible bearing on the existence of life elsewhere. They also integrate the sciences with some nonscience subjects, such as art, history, and social sciences, in a natural manner specified by the SETI/Life-in-the-Universe connection.

The activities emphasize hands-on learning and how knowledge is acquired in a way that develops both communication skills and critical thinking. SETI is expected to interest young students enough to upgrade their skills in the sciences and to sustain their interest in seeking careers in science

Descriptors: Art, Book, Communications Skills, Critical Thinking, Elementary School, History, Inquiry Learning, Middle School, Multidisciplinary, Science, Social Sciences, Student Activities, Supplemental, Units, Universe

Judith H. Tamburlin
State University of New York, Buffalo
Anatomical Sciences
4240 Ridge Lea Road
Buffalo, NY 14260
(716) 831-3051

9252976
$274,105
Start: 6/1/92
(36 months)

"Hands-On" Experiences for Exploration of the Life Sciences

This project develops a set of 100–200 haptic diagrams in life science. The materials are designed for use by visually impaired, learning-disabled, and at-risk students in grades 3 through 7. These line diagrams use various textures and braille labels along with auditory tapes, braille text, and ink-print text to provide further information about the content of the diagram. Teachers are able to select from the available materials to respond to the learning modalities of students found in a typical classroom. Supplemental print materials for the teacher provide follow-up activities that are designed to engage disabled students in hands-on, inquiry learning. These materials are intended for use in cooperative learning settings in the regular education classroom to decrease the isolation of disabled students and increase their interest and participation in science. The topics for the diagrams are selected for their compatibility with the most commonly used science textbooks and with the overarching themes of Science For All Americans. Topics include earth science, biology, ecology, and human biology. The materials are to be field tested and disseminated through the National Science Teachers Association, the "Special Net" system of the U.S. Resource Centers and Clearinghouses.

Descriptors: At-Risk Students, Audiotape, Biology, Braille, Cooperative Learning, Earth Sciences, Ecology, Elementary School, Hands-On Activities, Inquiry, Integrated Curricula, Learning Disabled, Life Sciences, Middle School, Teacher Materials, Text, Visually Impaired

Richard Hudson
Greg Sales, David Heil (Co-PIs)
Twin Cities Public Television
KTCA Science Unit
172 East Fourth
St. Paul, MN 55101

9255777
$446,302
Start: 5/1/93
(18 months)

Newton's Apple Multimedia Collection

This project is to develop "Newton's Apple Multimedia Collection" from their unique collection of multimedia-based science instruction materials built from the successful PBS series. These materials are designed to stimulate creativity and improve the quality of teaching and learning for all grade levels. This pilot project includes three videodisks of 25 to 30 segments selected from over 200 in the areas of physical, life, and earth sciences. Technology education is included in many of the video segments and addressed in greater detail in the printed support materials. The segments, which are each 5 to 10 minutes long, supplement active classroom learning. The program includes the development of video teacher workshops, printed teacher support materials and computer software. The videodisks are produced in Spanish and English, and there is also a videodisk version for the hearing impaired. This project has a well-documented rationale on conceptual change, curriculum development models, and effectiveness of videodisk technology and television usage.

Descriptors: Computer Software, Earth Sciences, Elementary School, Hearing Impaired, High School, Interdisciplinary, Life Sciences, Middle School, Multimedia, Physical Sciences, Spanish, Supplemental, Teacher Materials, Teachers, Technology Education, Videodisk

Tim Burr
U.S. Department of Education
Office of Educational Research and Improvement
Washington, DC 20202
(202) 219-1673

9255276
$60,000
Start: 4/15/92
(12 months)

Helping Your Child Learn Science

This book was developed by the Office of Educational Research and Improvement (OERI) to help parents meet goal 4 of the National Education Goals. It has some descriptive text, a number of activities that parents and children can do together, and an extensive list of resources for parents and children. The book has been very successful, and OERI has printed 150,000 copies and distributed them through the Consumer Information Center. The copies being printed under this agreement will fill orders still being received by the Consumer Information Center for free copies. The inside front cover will indicate that these copies were printed and distributed by the National Science Foundation. When this edition is revised, the principal investigator will check with NSF to ensure that the science in the book is current.

Descriptors: Book, Parental Involvement, Student Activities

Lawrence F. Lowery
University of California, Berkeley
Lawrence Hall of Science
Berkeley, CA 94720
(510) 642-8941

9150097
$1,147,149
Start: 7/15/91
(36 months)

Full Option Science System—Kindergarten Through Grade 2 (FOSS K–2)

The Center for Multisensory Learning at the Lawrence Hall of Science develops a 3-year primary school general science project, the Full Option Science System, Kindergarten Through Grade 2 (FOSS K–2). The project extends the existing FOSS 3-6 program down to the early childhood years. FOSS K–2 activity development is guided by the same philosophy and theory of cognitive development that was used successfully in the FOSS 3–6 project. The results are a collection of eight topical modules, featuring multisensory activities that are technically and developmentally appropriate for all students in the grades for which they are suggested and are easy for typical teachers to use.

The FOSS K-2 project develops three major instructional products in conjunction with Encyclopedia Britannica Educational Corporation,

two school districts (Vallejo and Mt. Diablo), a national network of 10 test directors, and the schools with which they work. These products are (1) eight teacher guides for the eight modules, including background, objectives, preparation, lesson plans, discussion questions, language and math extensions, and take-homes; (2) eight complete student equipment kits, attractively and efficiently packaged, including manipulatives, student sheets, and study posters; and (3) study posters and science stories to be read to students. Study-poster books and narrative stories help students transfer the content of the activities to everyday situations. Special attention is directed to making the FOSS K–2 activities exciting for teachers to use with students. The end product is a complete, developmentally sound K–6 program.

Descriptors: Earth Sciences, Elementary School, Kits, Life Sciences, Modules, Multisensory, Multiyear Curriculum, Physical Sciences, Science, Science Stories, Student Activities, Supplemental, Take-Home Materials, Teacher Materials, Videotape

Mary B. Rowe
University of Florida
Department of Instruction and Curriculum
Gainesville, FL 32611
(904) 392-0761, extension 264

9255703
$249,007
Start: 6/1/93
(18 months)

A Self-Help Elementary Level Science Video Project for Adults: Part II

The Self-Help Elementary Level Science (SHELLS) Part II is the continuation of the video project SHELLS I. It is intended primarily for administrators, teachers, school volunteers, and parents to learn how to minimize, circumvent, or even eliminate some of the obstacles of doing science in elementary schools. Because physical science is the most problematic content for adults and children alike, 80 percent of series content deals with physical science concepts. Part I consists of a set of seven half-hour demonstrations: five programs on force and motion topics, one on instruction using physical science concepts, and one show on administration topics related to implementing and maintaining a strong elementary science program. In addition there is a 10-minute overview tape for Part I to serve orientation and dissemination functions. The design goal is to make the demonstrations sufficiently appealing and instructive to motivate adult viewers to become advocates for elementary science and to feel some satisfaction and joy in doing so. This proposal for SHELLS Part II provides print materials for the videos completed in Part I and an in-depth evaluation of the project.

Descriptors: Elementary School, Physical Sciences, Print Materials, Teachers, Videotape

Aravind Joshi
Pamela Freyd, Christine Massey (Co-PIs)
University of Pennsylvania
Trustees of the University of Pennsylvania
133 South 36th Street, Suite 300
Philadelphia, PA 19104
(215) 898-7293

9252885
$550,622
Start: 9/1/92
(48 months)

Constructing Science: Materials and Activities for Kindergarten and First Grade

This project develops instructional materials for kindergarten and 1st-grade children; the materials developed emphasize active science learning and exploration. This is an outgrowth of a colloquium series initiated by the Citizens' Committee for Public Education in Philadelphia and facilitated by directors of PENNlines. The project is a collaborative effort among classroom teachers, science educators, university psychology and education researchers, and university scientists. Its goal is to improve the quality of science education and to ensure that adequate time is spent on science education in kindergarten. Additionally, this project emphasizes the learning of developmentally appropriate science concepts and processes. Other methods are utilized to help the children gain positive attitudes, motivation, and vocabulary that serve as a strong foundation for further formal science study.

Descriptors: Book, Earth Sciences, Elementary School, Environmental Science, Mathematics, Minorities, Physical Sciences, Science, Student Activities, Supplemental, Teachers, Urban School

Raymond Kessel
James Stuart, Louise Elbaum (Co-PIs)
University of Wisconsin, Madison
Department of Medical Genetics
750 University Avenue
Madison, Wisconsin 53706
(608) 262-1234

9252950
$542,049
Start: 4/1/92
(36 months)

Development of Elementary, Middle, and Secondary School Instructional Materials in Genetics and Biotechnology

This project develops and revises instructional materials for K–12 based on genetics activities that have been developed by classroom teachers. These 60 genetics activities (20 elementary, 20 middle school, and 20 high school) can also be integrated into existing science texts. They address genetics in several contexts. Some integrate genetics content with arts or language curricula. Others address issues of genetics in social and personal contexts. In addition to the development of genetics modules, workshops illustrating project use are held at national professional conferences to share these and other activities with teachers at the precollege level.

Descriptors: Biology, Biotechnology, Book, Content Integration, Curriculum, Elementary School, Ethics, Genetics, High School, Inquiry, Life Sciences, Middle School, Modules, Societal Issues, Supplemental, Teacher Enhancement, Workshop

T Wendell Butler
Karen Sotero, Saundra Nettles (Co-PIs)
Young Astronaut Council
1308 19th Street, NW
Washington, DC 20036
(202) 682-1984

9054646
$1,194,463
Start: 2/1/91
(24 months)

Project STARLAB

A comprehensive, schoolwide pilot program is designed to create a stimulating science-based learning environment within two inner-city Washington, DC, schools serving grades K–6. It includes the development and use of high-quality, design-based science and mathemat-

ics materials, teacher kits, teacher training, and supplemental activities that can be integrated into all subject areas. In addition to improving science and mathematics achievement, the materials help children develop critical thinking skills and methods of analysis that can be used in all areas of life. A teacher-enhancement component develops the teacher's pedagogical skills and content knowledge to deliver the materials in inner-city schools. Parental and community involvement reinforces the information presented. The project is designed to be replicated in inner-city schools nationwide.

Descriptors: Community Involvement, Critical Thinking, Elementary School, Kits, Mathematics, Minorities, Multidisciplinary, Multiyear, Parents, Problem Solving, Science, Student Activities, Teacher Training, Technology Education, Urban School

Elementary Mathematics

Steven Heard
Rob Mikuriya, Kathie Heard (Co-PIs)
Foundation for Advancements in Science and Education
FASE Productions
4801 Wilshire Boulevard, Suite 215
Los Angeles, CA 90010
(213) 937-9111

9450267
$500,000
Start: 9/1/94
(12 months)

"The Eddie Files"

The producers of "Futures with Jaime Escalante," "Interactions," and "Good Morning, Miss Toliver" have developed a new PBS in-classroom series for students ages 8–12. This series, titled "The Eddie Files," consists of four 15-minute segments crafted for teacher use. Each segment is dense with wonderful career applications of math, science, and technology; effective classroom techniques modeled by Ms. Kay Toliver; and narration/navigation provided by Eddie, a fictitious student in Ms. Tolliver's class. Eddie takes students to the real world where they meet people in real jobs. Students learn about real-life applications of mathematics through the eyes of Eddie. The series is released through a multiple distribution strategy including PBS Learning Services and videocassette tapes, and it will be available for broadcast into the home. Ancillary materials consisting of (1) a teacher support print component, lesson plans, and potential staff development activities and (2) a student explorations component have been produced and are being distributed. Extensive and sustained outreach and promotional activities accompany the release of the program to ensure broad utilization of the series.

Descriptors: Careers, Elementary School, Mathematics, Real-World Problems, Science, Teacher Materials, Technology, Television Programs, Videotape

---

Carl P Long
Maryland Public Television
11767 Owings Mills Boulevard
Owings Mills, MD 21117
(410) 581-4105

9255782
$2,118,922
Start: 9/15/93
(48 months)

Numbers Alive!

The Numbers Alive! project models the use of number sense and provides opportunities for its practice through the production of 10 half-hour television programs for students, one program for parents and care-givers, and print materials in support of both types of programs. The targeted student audience is 5th and 6th graders. The series emphasizes number concepts and problem-solving strategies in support of the National Council of Teachers of Mathematics standards.

Descriptors: Conceptual Learning, Mathematics, Middle School, NCTM Standards, Number Sense, Print Materials, Problem Solving, Television Programs

---

Susan Russell
Technical Education Research Center (TERC)
2067 Massachusetts Avenue
Cambridge, MA 02140
(617) 547-0430

9050210
$3,509,397
Start: 9/90
(36 months)

Investigations in Number, Data, and Space: An Elementary Mathematics Curriculum

This project develops a comprehensive mathematics curriculum for grades K-6 based on investigations in number, data, and space; it emphasized depth and understanding. The curriculum stresses mathematics as a pattern-finding science, makes the discipline more accessible to both students and teachers, and builds teachers' knowledge of how students learn mathematics. TERC designs, evaluates, and disseminates 10 curriculum modules for each grade level. Each module focuses on a set of related and developmentally appropriate investigations which introduce key mathematical contents within a compelling context. The teaching is built into the print materials (through scenarios depicting analytic work in classrooms) and into videotapes of effective mathematics teaching in action. Evaluation of the project includes formative research, as well as an examination of the impact of the curriculum on students and teachers. Investigations are disseminated through publications aimed specifically at elementary school educators. The curriculum is published by Dale Seymour Publications, which has made a major financial commitment to the project.

Descriptors: Elementary School, Investigations, Mathematics, Modules, Print Materials

---

Richard Hudson
Greg Sales, David Heil (Co-PIs)
Twin Cities Public Television
KTCA Science Unit
172 East Fourth
St Paul, MN 55101

9255777
$446,302
Start: 5/1/93
(18 months)

Newton's Apple Multimedia Collection

This project is to develop "Newton's Apple Multimedia Collection" from their unique collection of multimedia-based science instruction materials built from the successful PBS series. These materials are designed to stimulate creativity and improve the quality of teaching

and learning for all grade levels. This pilot project includes three videodisks of 25 to 30 segments selected from over 200 in the areas of physical, life, and earth sciences. Technology education is included in many of the video segments and addressed in greater detail in the printed support materials. The segments, which are each 5 to 10 minutes long, supplement active classroom learning. The program includes the development of video teacher workshops, printed teacher support materials and computer software. The videodisks are produced in Spanish and English, and there is also a videodisk version for the hearing impaired. This project has a well-documented rationale on conceptual change, curriculum development models, and effectiveness of videodisk technology and television usage.

Descriptors: Computer Software, Earth Sciences, Elementary School, Hearing Impaired, High School, Interdisciplinary, Life Sciences, Middle School, Multimedia, Physical Sciences, Spanish, Supplemental, Teachers, Teacher Materials, Technology Education, Videodisk

Max Bell
University of Chicago
5801 South Ellis Avenue
Chicago, IL 60637
(312) 962-8805

9252984
$5,650,579
Start: 9/1/92
(72 months)

Everyday Mathematics

The Everyday Mathematics: 4–6 Project is to create a complete mathematics curriculum for grades 4, 5, and 6. It assumes that entering 4th graders have had a rich and varied mathematical experience in grades K–3. The materials build on the Everyday Mathematics K–3 curriculum. The Everyday Mathematics Curriculum emphasizes explorations of data and mathematical modeling in common life situations and in the natural and social sciences, arts, and language. Mathematics' structures and algorithmic procedures are attended to as important issues in effective mathematical modeling. Pedagogic approaches emphasize small group and partner cooperative work.

Descriptors: Cooperative Learning, Data Collection, Elementary School, Mathematics, Multiyear Curriculum, Real-World Problems

Patricia Baggett
University of Michigan, Ann Arbor
Ann Arbor, MI 48109
(313) 764-1817

9353068
$450,000
Start: 8/15/94
(35 months)

Incorporating Calculators into Elementary Mathematics

This project investigates the use of calculators in teaching mathematics in kindergarten through grade 5. From the beginning, children are exposed to real numbers (not just positive integers), and they learn to perform arithmetic operations mentally on simple numbers and with a calculator otherwise. Drill is replaced by projectlike lessons in which children are active participants. Children use real objects, make measurements, and engage in interdisciplinary activities as essential parts of the lessons. The Jackson Intermediate School District in Michigan, the University of Michigan, and the University of Colorado are collaborating in the project. Teachers have been using many lesson units for several years in a number of participating schools. The planned outcome is to have a complete classroom-tested set of K–5 educational materials, including three videotapes of classroom calculator activities.

Descriptors: Calculators, Elementary School, Interdisciplinary, Mathematics, Videotape

Thomas A. Romberg
University of Wisconsin, Madison
Wisconsin Center for Education Research
1025 West Johnson Street
Madison, WI 53706
(608) 263-4285

9054928
$1,702,780
Start: 8/1/91
(60 months)

Mathematics in Context: A Connected Curriculum for Grades 5–8

This project develops a complete mathematics curriculum for grades 5–8. The curriculum includes instructional materials, staff-development materials, and assessment materials.

The instructional materials consist of 40 units, each of about 3–4 weeks duration. They are developed in the spirit of the National Council of Teachers of Mathematics Standards, grades 5–8. A teacher's guide provides information on activities, videotape clips, and technological tools related to each unit.

The staff-development materials consist of two pieces: an in-service program and a teacher-network model. The latter component, which is designed to lend support to teachers, includes such things as electronic bulletin boards and collaborative organizations.

The assessment materials consist of instructional assessment materials and a core curriculum readiness examination to assess the students' readiness for the core curriculum as described in the grades 9–12 section of the NCTM Standards.

Descriptors: Assessment, Calculators, Computers, Elementary School, Mathematics, Middle School, Multiyear Curriculum, NCTM Standards, Networking, Student Activities, Teacher Materials, Units, Videotape

Middle School Science

Patsy Johnson
Booneville School District
P.O. Box 358
Booneville, MS 38829
(601) 728-2171

9022125
$25,357
Start: 12/1/90
(12 months)

Project STOP (Students Teaching Others Paleontology)

Students Teaching Others Paleontology (STOP) is an 8th and 9th grade science project initiated for girls to explore, interpret, and record the geological history along the U.S. Highway 45 corridor in northeast Mississippi. The research fossil site is located approximately 3 miles from the Booneville High School. This exploratory activity is novel and timely and results in research experiences for students engaged in the fossil collections.

These scientific discoveries of 60-million-year-old fossils provide students with a solid understanding of time and space; and their access to specialized data helps them to verify and classify the fossils. The site has been identified by geologists and geographers at Mississippi State University as unique. The enlargement of U.S. Highway 45 through this area has made available exposures of Cretaceous and Tertiary rocks that contain an impressive amount of fossil material. The fossil material, which is well-preserved and contains species rarely seen in Mississippi or elsewhere, has been evaluated by the department at Mississippi State University and deemed to be one of the more important in this region.

A team of geologists from the University of Mississippi and Mississippi State University is assisting in the removal and identification of the fossils. Scientists and mentors from other agencies and universities are serving as role models for the women and minorities targeted by Project STOP. The students' fossil collections will be preserved in their libraries and at the geology museum at Mississippi State University.

Descriptors: Exploration, Female, Geology, Grade 8, Grade 9, Minorities

---

H. Eugene Stanley
Boston University
88 East Concord Street
Boston, MA 02215
(617) 353-2000

9353900
$1,399,714
Start date: 1/15/94
(48 months)

The Random Universe: An Interdisciplinary Approach to Investigating Patterns in Nature

Most instructional materials in classical science assume a strict cause-and-effect relationship. More recent research in many disciplines demonstrates that microscopic randomness leads to macroscopic patterns. Examples, drawn from physics, chemistry, biology, and earth science, include natural patterns in nerve cells, lightning, river deltas, tree branches, galaxy formation, ruggedness of coast lines, and growth of materials, to name a few. Each discipline-related workbook incorporates hands-on activities, prediction and hypothesizing activities, laboratory experiments, computer simulations, data analysis, modeling, and assessment instruments which are based on previous work in research in teaching and learning. The materials confront students' preconceptions while introducing important concepts underlying the study of patterns in nature. Students learn to think like scientists. Preliminary research demonstrates that this approach is particularly attractive to women and minority students. The projects are designed to encourage students to work in cooperative groups and to encourage teachers to provide cognitive apprenticeships—modeling the student behavior, providing scaffolding as needed, and fading as the students learn the skills. Publication of modularized student booklets and associated software and videos is through Springer-Verlag.

Descriptors: Book, Computer Software, Cooperative Learning, Hands-On Activities, Laboratory Activities, Multidisciplinary, Student Activities, Videotape

---

Sandra L. Cooper
Ralph S. Cooper, Charles E. Walker (Co-PIs)
Creative Enterprises
76 Santa Ana Avenue
Long Beach, CA 90803
(310) 987-3459

9050186
$382,826
Start: 8/1/91
(36 months)

Interactive Materials to Stimulate Minorities Toward Engineering Careers

This project aims to motivate minority students to prepare for careers in science- and mathematics-based professions, especially engineering. The technical approach is to create interactive media, including both a computer program and text-based materials, to stimulate and inform students concerning the activities of professional engineers, the academic and social life in college, and course requirements for both high school and college. The combined media use an "adventure" format with many possible scenarios dependent upon the student's selection, plus humor and special effects (e.g., computer sound and animation) to sustain interest.

Examples relate the secondary school course content to engineers' practices. The program is being conducted in conjunction with California State University, Long Beach, MESA (minority outreach) and MEP (Minority Engineering Programs), and in conjunction with Compton middle schools (grades 6–8). A computer simulation with text accompaniments and teacher's guides has been completed and field tested in the junior high schools. The success of this model will eventually lead to a range of materials for economical, nationwide dissemination and application on many educational levels for minorities, women, persons with disabilities, and other special and general populations.

Descriptors: Animation, Careers, Computer Simulations, Computer Software, Engineering, Female, High School, Mathematics, Middle School, Minorities, Physically Impaired, Science, Supplemental, Teacher Materials, Urban School

---

Ellen M. Nelson
Wendell Potter, Joan Bissell (Co-PIs)
Decision Development Corporation
2680 Bishop Drive, Suite 122
San Ramon, CA 94583
(510) 830-8896

9154095
$1,434,827
Start: 6/1/92
(24 months)

A Middle School Technology-Based Curriculum Management Tool

A 7th grade multimedia science curriculum, using a constructivist pedagogy, a thematic approach, and a multidisciplinary organization of science has already been developed by the proposers under other funding. In this project, compatible 6th and 8th grade curricula are developed which integrate material from earth science, life science, and physical science, using four different themes at each grade level. The large ideas of science and science as a way of knowing are stressed. Each unit includes (1) teacher lessons; (2) student activities and bibliographic resources stored in software; (3) a learning-resource management tool, compatible with either IBM or Macintosh computers, which allows teachers to choose, write, and edit lessons; assign student activities; access videodisks; and review supplemental material; (4) four videodisks; (5) eight hands-on activities; and (6) pre- and in-service teacher preparation models. Evaluation and teacher enhancement are done in cooperation with nearby universities.

Descriptors: Comprehensive, Constructivist Approach, Earth Sciences, Hands On Activities, Integrated Activities, Life Sciences, Middle School, Multidisciplinary, Multiyear Curriculum, Physical Sciences, Science, Student Activities, Teacher Materials, Thematic Units, Videodisk

---

Wayne A. Moyer — 9350490
Stephen L. Rabin (Co-PI) — $243,500
Educational Film Center — Start: 9/15/93
5101-F Backlick Road — (12 months)
Annandale, VA 22003
(703) 750-0560

VARIATIONS: A Middle School Life Science Project

This proposal seeks funds to develop and produce a set of 12 instructional video-based units on key topics in the life sciences. The video units are to be produced by the Educational Film Center in association with the Montgomery County (Maryland) School System and are designed to enrich existing as well as newly developing life science curricula. The units will provide a bridge for teachers as they incorporate the new educational technology and modern cognitive theory in their science-reform curricula. The final products will consist of 12 video units produced both in laser disk-software and videocassette-print formats and teacher support materials directed to middle school teachers.

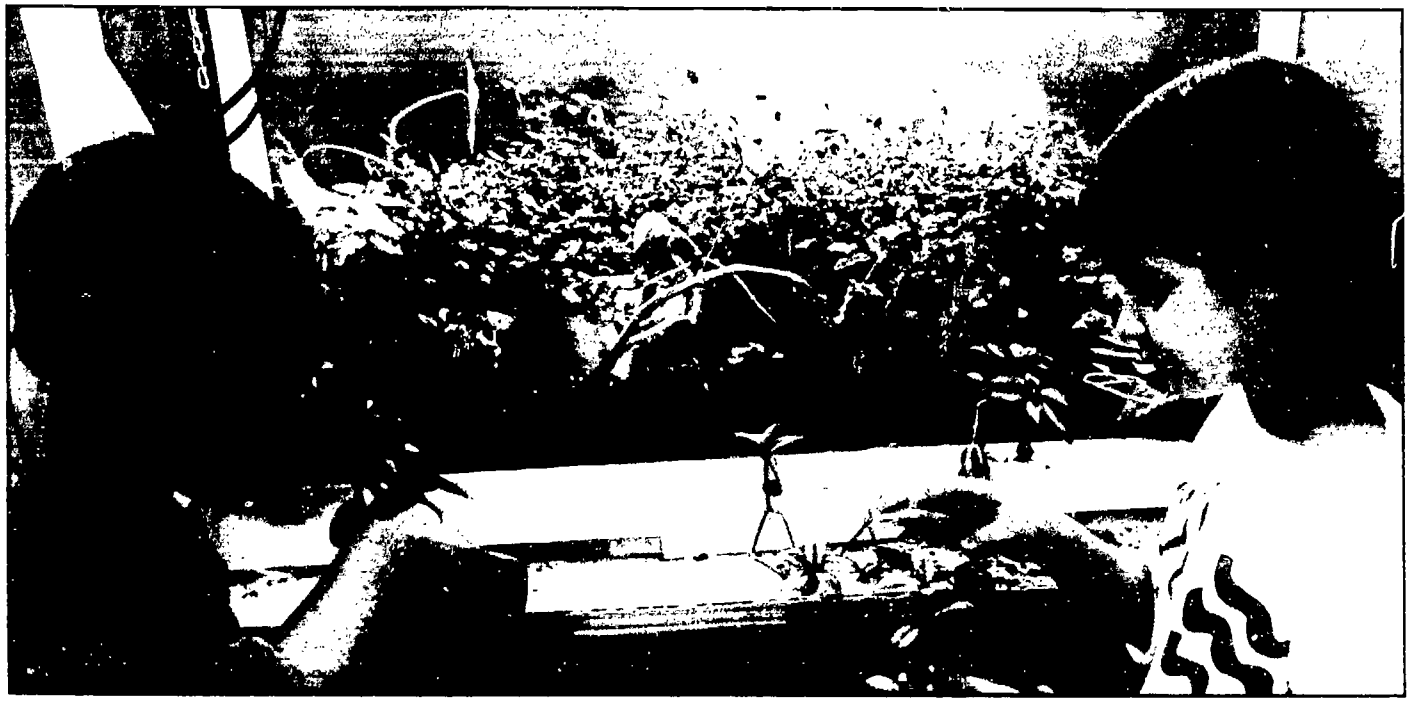
Descriptors: Book, Computer Software, Laser Disk, Life Sciences, Middle School, Print Materials, Supplemental, Teacher Materials, Videocassette, Videodisk, Videotape

---

Edgar Garbisch — 9353030
Environmental Concern, Inc. — $19,694
P.O. Box P — Start: 5/15/94
St. Michael's, MD 21663 (16 months)
(410) 445-9620

Wetland Creation, Restoration, and Enhancement Guide

The intent of this project is to prepare a guidebook, for students and teachers of grades 7–12, that will encourage, facilitate, and guide the creation, enhancement, and restoration of wetlands. The guide is expected to be about 150 pages long and will be divided into two parts. Part I will provide information on the common wetland types with integrated learning activities. Part II will include information on identifying potential sites for implementing the project and will include the information necessary to achieve these objectives. The guide will also include information on ecological functions, hydro-



logic regimes, and plant communities of wetlands. It will provide an alternative for hands-on projects that will result in a schoolyard habitat well suited for student monitoring, research, and instructional activities. An existing urban wetland restoration project will be selected to field test this project.

Descriptors: Book, Ecology, Environmental Science, Hands-On Activities, High School, Middle School, Projects, Teacher Materials, Wetlands

---

Maurice Bazin
Exploratorium
3601 Lyon Street
San Francisco, CA 94123
(415) 563-7337

9450279
$387,940
Start: 9/1/94
(17 months)

The Multicultural Science and Mathematics Snackbook

The Exploratorium Teachers Institute proposes to develop, test, and distribute three multicultural science and mathematics monographs for use in middle and high school classrooms. After extensive classroom testing, the three monographs will be revised and combined into one book for national dissemination. These publications will (1) present science and mathematics through tools and designs from a variety of world cultures and (2) provide related hands-on, investigatory activities for students. The philosophy and format of the publications will be based on the successful *Exploratorium Science Snackbook*. The initial publications will be self-published and distributed. A revised product, based upon feedback from initial users, will be published commercially. The proposed publications are designed to increase awareness of multicultural issues for all students, while making science more relevant and approachable to minority students.

Descriptors: Book, Hands-On Activities, High School, Mathematics, Middle School, Minorities, Multicultural, Science, Student Activities

---

Daniel LaRose
Gregory Vouros (Co-PI)
Greenfield Community College
College Drive
Greenfield, MA 01301
(413) 774-3131

9354547
$20,000
Start: 2/15/94
(30 months)

TEME: A Plan for Interdisciplinary Curriculum Development in Hands-On Science Education for Middle School and Community College Students

The purpose of this proposal is to further develop the TEME (Totally Enclosed Modular Environments) model as the experiential laboratory of the Human Ecology curriculum. Expanding the TEME model to include an oceanographic research simulation will enable Greenfield Community College to provide both college and middle school students with an opportunity to participate in an exciting hands-on science education program that integrates broad scientific content and effective group skills, providing a practical framework for understanding ecological and social problems. The original TEME curriculum model features a simulated shuttle orbiter experience as a metaphor for "Spaceship Earth." The TEME model will be adapted to the study of the oceans, using a deep-sea submersible simulation as a vehicle for exploring this vast and still mysterious environment. We will add new content to the module program and upgrade the technology to run the simulation. In addition to Greenfield Community College faculty, curriculum specialists and middle school teachers are involved in the curriculum development. We will develop written curricular materials for middle schools as well as software that can be used on ordinary PCs in the schools. The impact on students will include greater motivation, improved math/science skills development, greater clarity of career goals, and a broader ecological awareness.

Descriptors: Careers, Computer Simulations, Computer Software, Ecology, Environmental Science, Hands-On Activities, Human Ecology, Oceanography, Societal Issues

---

Helane Selin
Hampshire College
Harold F. Johnson Library
Amherst, MA 01002
(413) 549-4600

9154088
$20,095
Start: 7/1/91
(12 months)

Comparative Scientific Tradition: A Bibliography of Works on Non-Western Science

An annotated bibliography of more than 1,200 items is produced which covers Asian, African, Islamic Middle East, Latin American, and precontact North American science and medicine. This bibliography is of value to teachers, students, and curriculum developers who want to include examples of the cultural relativity of the scientific enterprise. The bibliography is arranged by location, with an extensive subject index. The bibliography is published and the ideas disseminated to teachers through networks, partnerships, journals, and talks.

Descriptors: Bibliography, International, Medicine, Multicultural, Resource Materials, Science, Teachers

---

Irwin Shapiro
Ursula Marvin, Darrel Hoff (Co-PIs)
Harvard University
Holyoke Center 458
Cambridge, MA 02138
(617) 495-1000

9252887
$227,844
Start: 5/1/92
(12 months)

Project IMAGE: Investigative Materials about Global Environments

All global environmental issues can be linked to an earth science topic. Existing earth science courses, therefore, provide an efficient route for reaching a significant number of the nation's students. A survey of 1,000 members of the National Earth Science Teachers Association yielded a 49 percent response, with 97 percent of the respondents favoring the use of imagery-based activities in their courses. Based on these and other data, researchers conclude that it is likely that these materials will reach 750,000 students per year, greatly increasing the awareness of the nation's next adult generation to

the environmental issues that they will face. Using satellite and high altitude imagery, the project will develop 15 hands-on modules that will confront students with the problems and challenges of our global environment. Twenty master earth science teachers will work with the staff on the development of the activities during each of three summer institutes. These teachers will field test the materials for commercial publication during two academic years. A series of implementation workshops in cooperation with the commercial publisher to disseminate these materials will be held.

Descriptors: Earth Sciences, Global Environmental Issues, Hands On Activities, Student Activities

Franzie Loepp
John A. Dossey, Tom Fitch (Co PIs)
Illinois State University
The Center for Mathematics, Science, and Technology (CeMast)
Julian Hall 210W
Normal, IL 61761
(309) 438-3084

9252954
$1,951,275
Start: 7/1/92
(36 months)

Integrated Mathematics, Science, and Technology (IMAST)

CeMast develops integrated materials for 7th-grade students centered around the topics of biotechnology, manufacturing, and forecasting. Each unit includes objectives, experiential learning, appropriate use of multimedia, appropriate technology, and evaluation instruments. Attention is given to preparing materials that motivate all students—especially those from groups underrepresented in technological careers—to learn the foundational mathematic , science, and technology concepts by involving them in enriched learning experiences relevant to their daily lives.

CeMast, together with teachers, develops the materials, which are then piloted, revised, field tested, published, and disseminated through a marketing plan supported by a publisher. To maximize the potential for long-range impact, systemic problems that impede the implementation of integrated materials are identified and alternate solutions proposed. Implementation materials are developed so that systemic changes can be made and the materials taught with minimal teacher development. Student performance data are gathered to determine the increase in achievement in mathematics, science, and technology.

Descriptors: Assessment, Biotechnology, ChemCom, Comprehensive, Computer Software, Data Analysis, Earth Sciences, Hands-On Activities, Integrated Activities, Life Sciences, Mathematics, Middle School, One-Year Curriculum, Physical Sciences, Problem Solving, Real-World Problems, Science, Student Activities, Teacher Materials, Technology, Technology Education, Underrepresented Students

Kathleen Hogan
Alan R. Berkowitz (Co PI)
New York Botanical Garden
Institute of Ecosystem Studies
Box AB
Millbrook, NY 12545-0129
(914) 677-5976

9054634
$524,239
Start: 2/8/91
(24 months)

Eco-Inquiry: An Ecology Curriculum for Grades 5–6

The Institute of Ecosystem Studies produces, tests, and disseminates an ecology curriculum entitled "Eco-Inquiry." The foundation of this multidimensional, 8- to 15-week, 5th and 6th grade curriculum has been built through 4 years of local development and testing. The content of the modules includes exploration of food webs, decomposition, nutrient cycling, and the application to a local environmental issue. The materials also include assessment tools, concept-mapping guidelines, and a guide to food-web clues in schoolyard habitats. Eco-Inquiry has three distinctive features: (1) its emphasis on the conceptual underpinnings of ecological literacy, (2) its commitment to modeling the practice of science and scientists, and (3) its approach to developing students' inquiry skills and dispositions through modeling the scientific community in the classroom. Eco-Inquiry uses a diversity of teaching methods (e.g., collaborative learning, teaching for conceptual change) to engage students in activities that are imaginative and highly participatory.

Descriptors: Conceptual Learning, Cooperative Learning, Ecology, Elementary School, Hands On Activities, Middle School, Science Inquiry, Student Activities

Lyle M. Sonnat
Louisiana State University, Baton Rouge
Louisiana Sea Grant College Program
99 University Lakeshore Drive
Baton Rouge, LA 70803-4101
(504) 388-6977

9255714
$349,999
Start: 6/1/93
(36 months)

Project Tellus: Interactive Global Environmental Change Videos for Middle School Science

Project Tellus develops six multidisciplinary video modules on global environment change concerns and issues that are indigenous to the Gulf of Mexico. For this project, information for module production is synthesized from data provided by the Louisiana Sea Grant Program staff, classroom teachers, university scientists, state agency specialists, and from recent research results and findings on global change. The six modules are designed around general topics as follows: scientific process, climatic change, biodiversity, sea-level rise, exotic species, and water quality. Classroom teachers are extensively involved in the writing, development, and dissemination of the materials.

Descriptors: Biodiversity, Environment, Global Change, Middle School, Modules, Multidisciplinary, Videotape

James A. Kolb
Marine Science Society
PO Box 2079
Pousbo, WA 98370
(206) 842-5883

9252979
$471,398
Start: 8/15/92
(18 months)

FOR SEA: Revision and CD-ROM Expansion

Three successful marine science curricula and teacher training pack

ages, *For Sea, Mare*, and *Living in Water*, developed by the Marine Science Center, the Lawrence Hall of Science, and the National Aquarium in Baltimore, will be refined and enhanced in preparation for the production of two, multimedia compact disks (CD-ROM). Advances in CD-ROM technology coupled with increasing accessibility to the technology, make the compact disk an effective tool for curriculum development, use, and distribution. The compact disk will contain all text and graphic images from the three curricular projects and a comprehensive indexing system allowing materials to be utilized in a variety of manners, including thematically and topically, to effect curriculum integration. Training will be provided to an existing cadre of teacher trainers to maximize the implementation of the new curriculum and CD-ROM disk.

Descriptors: CD-ROM, Marine Science, Multimedia, Teacher Enhancement, Units

---

Michael S. Isaacson
Patricia G. Calarco (Co-PI)
Microscopy Society of America
P.O. Box MSA
204 Woods Hole Road
Woods Hole, MA 02543
(607) 255-4302

9355777
$15,000
Start: 9/15/93
(14 months)

Project MICRO: Microscopy in Curriculum—Research Outreach

This project is to do the research and development necessary to prepare trial instructional materials on microscopy and microscopes, how they work, and how they are used to answer questions in different fields of science in K–12 schools. The intent of this proposal is to develop a preliminary teaching guide and kit (a test module) that will provide an integrated constructivist approach to science learning by using the microscope to acquire knowledge in life, earth, and physical sciences. The materials will be developed in collaboration with the Lawrence Hall of Science in Berkeley, California. A unique opportunity is available to test the materials with the Excellence in Teaching Elementary Science (EXCITES) Program within a National Science Foundation funded project to be held at the University of California at Davis during the summer of 1993. The project includes a follow-up fall workshop for revisions and additional development, with continued participation and testing by the EXCITES teachers in the summers of 1994 and 1995. This phase of the project will culminate with a curriculum guide, which has been tested for 3 years and is ready for national distribution.

Descriptors: Constructivist Approach, Elementary School, High School, Kits, Microscopy, Middle School

---

Wayne A. Moyer
Russell Wright (Co-PI)
Montgomery County Public Schools
OIPD/DAS
850 Hungerford Drive
Rockville, MD 20850
(301) 279-3381

9154094
$1,038,919
Start: 2/15/92
(48 months)

Event-Based Science: Earth Science

This project develops a year-long, event-based earth science curriculum for middle school students. The materials include modular text, teacher resource notebook, and videotape and/or videodisk support. The project is focusing on the following instructional approaches: (1) it is topical and relevant to early adolescents; (2) the interdisciplinary nature of this even focus is enhanced by the collaboration between project writers, teacher panels, and consultant panels; (3) students are involved in the development of the materials; (4) it stresses alternative assessment techniques and grading strategies that reward success and downplay failure; (5) it uses the news media as one source; and (6) it is a national project developed as a collaborative effort of Montgomery County Public Schools, the U.S. Government, and professional and news agencies.

Descriptors: Alternative Assessment, Book, Curriculum, Data Analysis, Data Collection, Data Interpretation, Earthquakes, Earth Sciences, Environmental Science, Interdisciplinary, Meteorology, Middle School, Modules, Oceanography, Oil Spill, One-Year Curriculum, Problem Solving, Science, Teacher Materials, Videodisk, Videotape

---

Harriett S. Stubbs
Steven Businger, Walter Heck (Co-PIs)
North Carolina State University
Air Resources Research Consortium
1509 Varsity Drive
Raleigh, NC 27606
(919) 515-3311

9150001
$1,393,738
Start: 5/15/91
(48 months)

GLOBE-NET: Changes in the Global Environment

New instructional materials that incorporate scientific research on global environment changes are developed for grades 4–12, to be infused into ongoing curricula. The program capitalizes on 10 years experience in the development, publication, and dissemination of materials on air-quality issues and the network already established between scientists, educators, teachers, and students. GLOBE-NET creates, evaluates, and prepares materials that are bias-free and scientifically and educationally sound. These materials take into account findings of research scientists in content areas and current research on how students learn science.

These materials are designed to be infused into existing and established courses of study in life, earth, physical, environmental sciences—in biology, chemistry, physics, and other science curricula. Thirty units are developed on topics including acid rain, global warming, atmospheric pollution, and ozone depletion, as each relates to scientific concepts in biodiversity, microbial respiration, physics, chemistry, and meteorology. By dealing with global environmental changes, these materials provide hands-on experiences, cooperative and inquiry learning, and other research-based strategies. The materials are to be published by Carolina Academic Press and disseminated by Carolina Biological Supply Company and others.

This project translates and transfers the most current information on this vital topic to teachers, to students, and ultimately to the general

public. GLOBE-NET helps teachers, students, and parents learn more about science and is intended to help create an informed citizenry that is cognizant of scientific issues of major international concern. Cooperation between science education and the various science departments at North Carolina State University and science education at the University of Minnesota provides the expertise and breadth necessary for the project.

Descriptors: Biodiversity, Chemistry, Cooperative Learning, Elementary School, Global Change, Hands-On Activities, High School, Inquiry Learning, Interdisciplinary, Meteorology, Microbial Respiration, Middle School, Modules, Multidisciplinary, Parents, Physics, Research, Science

---

Tom Alcoze
Northern Arizona University
Box 4132
Flagstaff, AZ 86011
(602) 523-9011

9353217
$1,107,077
Start: 9/1/93
(48 months)

Native Science Connections

The proposed Native Science Connections project is designed to develop culturally relevant science modules that complement the existing science curricula in grades 4–6. The curricular materials in science and mathematics will focus on four Native American tribal nations: Zuni, Hopi, Apache, and Dine (Navajo) and will demonstrate the existence and validity of Native American sciences and mathematics as they are manifested within the traditions and cultures of the original peoples of the Americas. The project will be directed and developed by experienced Native American science teachers and education professionals. Materials produced from this project include four science modules that will be developed around environmental themes. They will be used in both Native American and mainstream classrooms.

Descriptors: Environmental Themes, Mathematics, Middle School, Modules, Native American Culture, Science

---

Mary Ray
Pacific Mountain Network
1550 Park Avenue
Denver, CO 80218-1661
(303) 837-8000
Fax: (303) 837-9797

9352943
$250,000
Start: 4/1/94
(23 months)

The Salmon Project

The project proposes a decision-making model that may be applied to the resolution of development vs. preservation conflicts in all regions of the country. The project is designed to promote student involvement and active participation through fact finding, data analysis, and debate. The supplemental materials produced in this project include (1) curriculum guides for students and teachers consisting of three units that contain 10 interrelated study modules ("Discover Threats," "Critical Thinking," and "Find Solutions"); (2) "The Salmon Network" (Net); (3) "The Salmon Project" television series (eight 10-minute video programs for national broadcast); and (4) "The Salmon Project" multimedia slide show, software, and CD-ROM(s).

Descriptors: CD-ROM, Computers, Computer Software, Critical Thinking, Data Analysis, Decision Making, Environmental Science, Science Technology, Societal Issues, Television Programs, Videotape

---

John Kelly
Recording for the Blind
20 Roszel Road
Princeton, NJ 08540

9252918
$289,115
Start: 7/1/93
(36 months)

Access to Science Materials for Print-Disabled Students

A Comprehensive Listing System is created to increase the amount of mathematics and science materials available in alternate formats including braille, large print, recorded, and electronic form in Canada and the United States for blind and print-disabled students in grades 3–14. Four major organizations serving print-disabled persons in North America are adding their bibliographic information to both the APH-CARL and UNION national databases, major databases serving Library of Congress users and institutions serving the visual-impaired and print-disabled. The collaborative also invites more than 400 small publishers and colleges with Disabled Student Services (DSS) Offices on their campuses to contribute other titles not presently included on the database. Materials are available in several languages to accommodate users' needs. As a part of this project, Recording for the Blind (RFB) provides training to DSS offices on RFB standards for recording science and mathematics materials to ensure uniform quality. They also train users, educators, and librarians on the new systems to increase use and minimize problems associated with the transition to college by print-disabled students.

Descriptors: Braille, Databases, Elementary School, High School, Language, Mathematics, Middle School, Postsecondary, Print-Disabled Students, Science, Visually Impaired

---

John A. Boynton
Society of Automotive Engineers, Inc.
400 Commonwealth Drive
Warrendale, PA 15086
(412) 776-4841

9450278
$759,557
Start: 8/1/94
(32 months)

All Systems Go!

The engineering design experience—designing, constructing, testing and evaluating, and communicating—is incorporated in three 6–8-week units for middle school students. Each unit is based on a "technological challenge" that requires the students to work as a design team to build and present their solutions to the challenge. The design challenges include development of a toy, a vehicle, and an amusement park ride at 6th, 7th, and 8th grades, respectively. The materials engage students in authentic engineering challenges that become the context for learning mathematics, science, technology education, social sciences, language arts concepts, and skills appropriate to middle school students. The students, teachers, and community members form learning teams in which students assume various engineering and marketing roles. The products include print materials, hands-on kits, and videos and videodisk reference materials, complemented by software tools. The materials are brought to schools by engineers

from industry who interact with the students and teachers as they engage the challenges.

Descriptors: Careers, Communications Skills, Engineering, Hands-On Activities, Mathematics, Middle School, Multidisciplinary, Real-World Problems, Technology Education, Videodisk, Videotape

---

Alan McCormack
San Diego State University Foundation
Department of Science Education
San Diego, CA 92182
(619) 594-6123

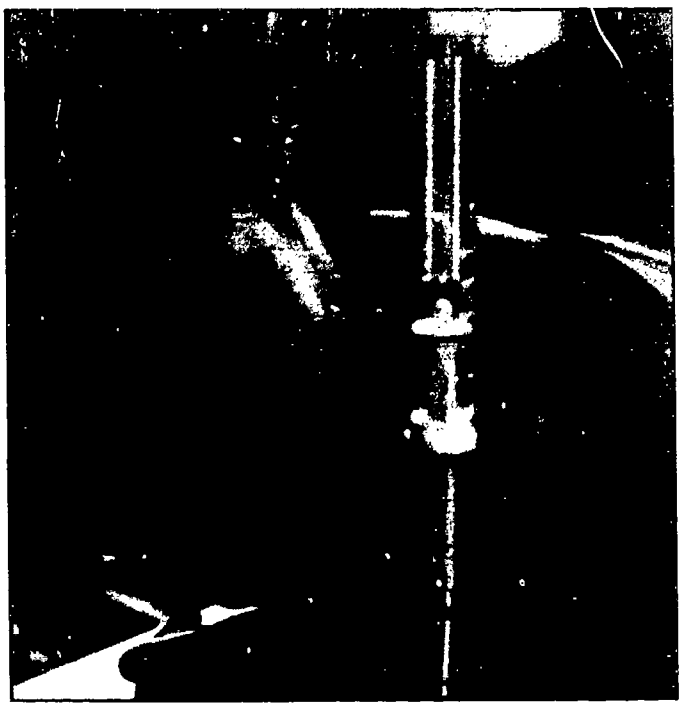
9252989
$1,053,663
Start: 3/15/93
(36 months)

VISTA: Visual Spatial Thinking Activities

Project VISTA (Visual Spatial Thinking Activities) is a curriculum development/research project designed to produce a bank of enrichment/enhancement science-oriented visual spatial thinking (VST) learning activities for grades K–8. University science educators, scientists, cognitive psychologists, and educational technologists will collaborate with 36 exemplary teacher associates to develop and refine Project VISTA activities over a phased 3-year period. The project is to produce the following outcomes: (1) a baseline of assessed VST abilities for children in grades K–8, (2) a battery of new VST assessment instruments, and (3) a large collection of innovative VST science learning activities, including hands-on experiences, interactive videotape-based experiences, computer-based experiences, and inquiring demonstrations. These enrichment materials will be made available nationally to build upon and supplement all existing K–8 science programs.

Descriptors: Assessment, Computer Sciences, Earth Sciences, Elementary School, Female, Hands-On Activities, Life Sciences, Middle School, Minorities, Physical Sciences, Science, Student Activities, Videotape

---



Jill Tarter
David H. Milne, Kathleen O'Sullivan (Co-PIs)
Search for Extraterrestrial Intelligence
(SETI) Institute
2035 Landings Drive
Mountain View, CA 94043
(415) 961-6633

9150120
$659,723
Start: 7/1/91
(36 months)

Life in the Universe: An Exciting Vehicle for Teaching Integrated Science

This project develops six guides for teachers: three for elementary and three for middle school grades. Each guide contains approximately 10 hands-on science activities, suitable for 10 to 12 weeks of study. The activities present many science and some nonscience disciplines that are naturally linked and integrated by a single research discipline: SETI—"Search for Extraterrestrial Intelligence."

The activities in each guide begin with a look at the Earth, solar system, and universe, then examine questions about life on Earth. The segments end with questions and imaginative constructs on the possibility of life elsewhere in the universe. In so doing, they present biology, earth science, physical science, and other standard classroom sciences from the fresh perspective of their possible bearing on the existence of life elsewhere. They also integrate the sciences with some nonscience subjects, such as art, history, and social sciences, in a natural manner specified by the SETI/Life-in-the-Universe connection.

The activities emphasize hands-on learning and how knowledge is acquired in a way that develops both communication skills and critical thinking. SETI is expected to interest young students enough to upgrade their skills in the sciences and to sustain their interest in seeking careers in science.

Descriptors: Art, Book, Communications Skills, Critical Thinking, Elementary School, History, Inquiry Learning, Middle School, Multidisciplinary, Science, Social Sciences, Student Activities, Supplemental, Units, Universe

---

Jerry Bell
Michael Alford (Co-PI)
ECA/Sonic Images Productions, Inc
4590 MacArthur Boulevard, NW
Washington, DC 20007
(202) 333-1063

9154111
$2,826,108
Start: 2/15/92
(36 months)

The Encyclopedia of the Environment

The Encyclopedia of the Environment is a comprehensive reference that promotes science education for grades 5–9 by using the environment as a theme. It takes advantage of trends in both state/federal education strategies, which increasingly advocate environmental education, and in science-reform efforts (for example, Project 2061), which advocate the use of major integrating themes. It is interdisciplinary, including science, history, economics, geography, social studies, and the humanities. It is designed in two formats: conventional books and interactive, multimedia CD-ROM. The print version (publisher: Macmillan Publishing Company) includes 12 144-page, separately indexed full-color volumes, which use case studies to integrate topics. Sidebars contain interesting facts, relevant information, explo-

rations of science themes, literature, careers, and biographies. The CD-ROM (publisher: Apple, Inc.) contains all print version material, plus audio, possibly full-motion video, and simulations. It is searchable through multiple paths, including topics, picture/movies, problems, point-of-view, historical/geographic, and careers. Also included is a set of 20 offline lessons, integrating the encyclopedia into science and social science curricula and providing a model for curriculum development. Contributing organizations include the American Association for the Advancement of Science, the World Bank, the U.S. Department of Energy, the National Aeronautics and Space Administration, the U.S. Environmental Protection Agency, as well as the National Gallery of Art, the Smithsonian Institution, and other government agencies.

Descriptors: Book, CD-ROM, Computer Simulations, Environment, Interdisciplinary, Middle School, Multimedia, Print Materials, Problem Solving, Project 2061, Science, Sidebars, Supplemental, Videodisk

Robert A. Williams
Southern Illinois University, Edwardsville
Curriculum and Instruction
Campus Box 20
Edwardsville, IL 62026-2222
(618) 692-3788

9154383
$1,078,380
Start: 8/1/92
(36 months)

The Rivers Project Curriculum

This project offers students and teachers the opportunity to engage in an activity-based program with real-world implications for the environment. The project's goal is to develop a national rivers curriculum that can cross the boundaries of traditional curricular areas to unite science, social science, and English. The curriculum propels a student force of "River Watchers," who research and monitor rivers in their respective communities. A set of teaching materials is developed that is applicable to any river; includes chemistry, biology, and geology/geography units; is interdisciplinary, incorporating English and social science elements into each set of materials; focuses on teaching data collection, analysis, and interpretation; and uses a computer telecommunication network to transmit and evaluate river data and writings. This curriculum-development project is a cooperative venture with state and national agencies, as well as with business and industry.

Descriptors: Aquatic Ecosystems, Biology, Book, Curriculum, Data Analysis, Data Collection, Data Interpretation, Environment, Environmental Monitoring, Field Studies, Flood Plains, High School, Multidisciplinary, Projects, Real-World Problems, Rivers, Social Sciences, Supplemental, Teaching Strategies, Telecommunications, Writing

R. Stephen Berry
Telluride Summer Research Center
P.O. Box 2255
Telluride, CO 81435
(619) 698-2167

9255709
$21,540
Start: 7/15/92
(12 months)

Bringing the Arts into the Sciences

This project develops prototype materials bringing the methods of the graphic, plastic, and dramatic arts to the teaching of sciences—three topics in science which are common to the experience of middle school or high school students and are topics of current research in science. The materials are for teachers to implement in classes the following year. The materials have input from students in a separate, concurrent summer program at the same location. The participants are teachers and MacArthur Fellows. The MacArthur Foundation co-funds the workshop. The results of the workshop may result in the production of more materials using the methods of the graphic arts in the study of science.

Descriptors: Art, High School, Middle School, Science, Thematic Units, Workshop

Dan Barstow
Technical Education Research Center (TERC), Inc.
2067 Massachusetts Avenue
Cambridge, MA 02140
(617) 547-0430

9050197
$2,634,633
Start: 2/1/91
(36 months)

Extending the National Geographic Kids Network to the Middle Grades

This 3-year project develops six units (or approximately 90 weeks) of supplementary science material for grades 7–9, organized around telecommunications-based, collaborative student research. The project involves coordinated curriculum and software development, formative and summative evaluation, research, dissemination, and teacher enhancement. The work is performed by TERC in collaboration with the National Geographic Society (NGS). NGS matches the NSF funding and acts as co-developer, producer, and publisher. Additional support for the inclusion of microcomputer-based laboratory material comes from IBM. Each unit requires students to gather data, share these data over a telecommunications network with students in other school districts, and analyze the collected data. This allows students to conduct scientific research as scientists.

Before gathering the data, students study the underlying science content and learn the experimental skills required to perform appropriate measurement. Following the data collection, students apply data-analysis techniques and examine the social significance of the problem addressed in the study. Study areas include Conditions for Growth, Trees, Student Fitness, Acid Deposition, Recycling and Composting, Radon, Alternative Energy Sources, Automobile Accidents, and Greenhouse Gases. Each unit is carefully tried and tested in typical classrooms. User software is developed to improve upon that developed for the elementary school NGS Kids Network, using some databaselike functions to extend significantly the analysis possible. Host software that simplifies and speeds up the collection of data is also developed.

Descriptors: Computer Software, Data Analysis, Grade 9, Middle School, Science, Student Research, Teacher Enhancement, Telecommunications

Paula H. Brady, Ted Hayes, Elizabeth Strand,
Debra Dorman, Marvin E. Richmond
Texas Learning Technology Group

9450241
$390,378
Start: 9/1/94

7620 Guadalupe Street
P.O. Box 2947
Austin, TX 78769
(512) 467-0222

(27 months)

TLTG Environmental Science

The Texas Learning Technology Group (TLTG) Environmental Science project intends to develop two multimedia instructional programs in the environmental sciences that relate to issues in the community. These programs are entitled *The Case of the Leaking Substance* and *Oil and Water*. The first of these two programs is based on a scenario in a fictitious low-income neighborhood that is being polluted by leaking petrochemical storage tanks. The program will consist of a videodisk case study, hands-on activities, discussions, and laboratory activities. The second program will investigate various factors that affect the level of soil and ground-water pollution near leaking fuel storage facilities. The programs can be used separately or together in an integrated format. Print-based materials will include a student edition of laboratory activities, notes, selected readings, and databases of resources needed for the activities and a teachers edition which supports the programs and provides assessment items.

Descriptors: Databases, Environmental Science, Ground Water, Hands-On Activities, Laboratory Activities, Middle School, Teacher Materials, Videodisk

---

Cecilia Lenk
Tom Snyder Productions
80 Coolidge Hill Road
Watertown, MA 02172
(617) 926-6000

9352942
$400,245
Start: 9/1/94
(18 months)

The Rain Forest Connection

This proposal is to develop and disseminate a middle school (grades 5–8) interactive CD-ROM-based science unit on "The Rain Forest Connection." This unit will be a series of cooperative group activities that use video, still images, animation, dramatic stories, and actual scientific data to involve students in science learning. The content will focus on the search in the Indonesian rain forests for plants containing compounds that may be successful in the treatment of cancer or AIDS. Print materials are also available. The unique nature of this project is that the CD-ROM unit may be used by a teacher with 30 or more students at the same time.

Descriptors: Animation, Biology, Book, CD-ROM, Environmental Science, Middle School, Rain Forest, Videotape

---

Keith Finkral
R. Todd, T. Hughes (Co-PIs)
Trenton State College
School of Technology
3 Armstrong Hall
Trenton, NJ 08650-4700
(609) 530-7600

9450249
$766,368
Start: 10/1/94
(48 months)

Professional LINKS Project

Instructional materials that integrate mathematics, science, and technology education are greatly needed. This project produces several instructional packages for secondary school students; the packages are consistent with the standards from each of the disciplines. The units are published as supplements in journals, such as *TIES Magazine*, *The Technology Teacher*, *The Mathematics Teacher*, and *The Science Teacher*, to reduce the lead time from development to use. They are developed in a collaborative effort among teachers, subject specialists, and practitioners from science and industry. Local and national support is available to help teachers and groups of teachers use the materials. The research and evaluation component measures the impact of the units and provides models for increased use. The products include the units, teacher guides for use of the materials, and support via electronic means. Themes to be engaged include science and technology of sports, biotechnology, music, and fire-prevention and control systems.

Descriptors: Elementary School, Hands-On Activities, High School, Mathematics, Middle School, Multidisciplinary, NCTM Standards, Science, Student Activities, Teacher Materials, Technology Education

---

Richard Hudson
Greg Sales, David Heil (Co-PIs)
Twin Cities Public Television
KTCA Science Unit
172 East Fourth
St. Paul, MN 55101

9255777
$446,302
Start: 5/1/93
(18 months)

Newton's Apple Multimedia Collection

This project is to develop "Newton's Apple Multimedia Collection" from their unique collection of multimedia-based science instruction materials built from the successful PBS series. These materials are designed to stimulate creativity and improve the quality of teaching and learning for all grade levels. This pilot project includes three videodisks of 25 to 30 segments selected from over 200 in the areas of physical, life, and earth sciences. Technology education is included in many of the video segments and addressed in greater detail in the printed support materials. The segments, which are each 5 to 10 minutes long, supplement active classroom learning. The program includes the development of video teacher workshops, printed teacher support materials and computer software. The videodisks are produced in Spanish and English, and there is also a videodisk version for the hearing impaired. This project has a well-documented rationale on conceptual change, curriculum development models, and effectiveness of videodisk technology and television usage.

Descriptors: Computer Software, Earth Sciences, Elementary School, Hearing Impaired, High School, Interdisciplinary, Life Sciences, Middle School, Multimedia, Physical Sciences, Spanish, Supplemental, Teacher Materials, Teachers, Technology Education, Videodisk

---

Althea G. Pearlman
University Corporation for Atmospheric Research
P.O. Box 3000
Boulder, CO 80307
(303) 497-1000

9450248
$599,957
Start: 9/1/94
(24 months)

Skymath Demonstation Project

This project involves students actively in mathematical problem solving using real-time weather data and on-line computer technology. Supplementary units (4 to 6 weeks in length) for the middle school mathematics curriculum are being developed. The units are to be cross-disciplinary. They will involve map-reading, geography, social studies, physics, and mathematics. Mathematical topics include discerning patterns, making conjectures, communicating mathematics, analyzing numerical and graphical data, measuring, symbolizing, and using scales.

Descriptors: Computers, Hands-On Activities, Interdisciplinary, Mathematics, Meteorology, Middle School

Beverly T. Lynds
University Corporation for Atmospheric Research
P.O. Box 3000
Boulder, CO 80307
(303) 497-1000

9255741
$85,894
Start: 9/92
(12 months)

Project Skymath—A Planning Grant

The University Corporation for Atmospheric Research (UCAR) convened a workshop on August 10–12, 1992 to create a comprehensive plan for Project Skymath, a program based on the success of UCAR's Unidata program. Unidata distributes weather and atmospheric data to universities and colleges in a format that facilitates computer manipulation of these data; Skymath proposed to do the same for the nation's precollegiate schools. Skymath participants included nationally known and respected math educators at all levels, mathematicians, and data-transfer and materials-development specialists. This team developed classroom materials that use daily weather and climate data in the teaching of mathematics at K–12 schools with an initial focus on grades 5–8. Plans for Project Skymath included the introduction of the Skymath materials to in- and pre-service teachers across the country. Lesson plans followed the standards of the National Council for Teachers of Mathematics (NCTM). For example, students collect and record real-time data; organize, manipulate, and graph these data; and learn to explore functions that rule these graphs. Skymath helps students to become active learners, incorporating mathematics, physics, atmospheric sciences, earth and environmental sciences, and computer technology.

Descriptors: Data Collection, Mathematics, Middle School, NCTM Standards, Weather, Workshop

Richard J. Saykally
University of California, Berkeley
Department of Chemistry
Berkeley, CA 94720
(510) 643-9475

9255829
$1,510,844
Start: 5/1/93
(48 months)

PRIME Science

PRIME Science provides an American adaptation of Salter's Science Program—a well-tested British multidisciplinary science program for middle grades. The science is balanced—not integrated—between life, earth, and physical sciences, developing conceptual understanding and integrating mathematics, technology, and decision making. The science is rigorous, interesting, and useful to the student. Among the major integrative themes that provide structure for grades 6 through 10 are the earth in space and properties of matter. Each unit begins with an application. The teachers' guides are directed at first-year teachers who are not teaching in their major disciplines. Included are student preconceptions, safety, background, ways of introducing the content, and assessment items. The visually stimulating, attractively designed student supplements for each of the 40 units contain the application, a summary of what students should know, what they need to learn, and the activities they can do. The materials are tested and rewritten by teachers and science educators at several sites throughout the United States. Professors at the University of California, Berkeley, review the materials for content accuracy. The British developers are part of the design team. The adaptation involves not only language translation but also changing data to interest American audiences and adding units to meet local interests and frameworks.

Descriptors: Adaptation, Earth Sciences, Life Sciences, Middle School, Modules, Multidisciplinary, Physical Sciences, Salter's Science Program, Student Activities

Herbert Thier
University of California, Berkeley
Lawrence Hall of Science
Berkeley, CA 94720
(510) 642-8718

9252906
$3,191,414
Start: 10/1/93
(48 months)

Issues-Oriented Science for Secondary School

The Science Education for Public Understanding Program (SEPUP) is composed of two 1-year courses: a more concrete course for middle school and a course emphasizing global issues for high school. The courses stress issues-oriented science and the use of scientific

evidence and risk–benefit analysis in making decisions. These courses continue the emphasis of the Chemical Education for Public Understanding Program (CEPUP) on societal issues involving the use of chemicals, and they expand the scope of the program by dealing with other issues in life, earth, and physical sciences and in technology. The eight new modules cover many of the large themes of science proposed in Project 2061 along with issues-oriented themes such as evidence-based decision making, uncertainty and controversy, and science and social systems. Course materials stress students as active participants in doing science with the goal of developing independent thinkers able to make evidence-based decisions about issues in science and technology. Materials include a teacher resource book, a student text, project and extension activities, kits, videotapes, and software. Assessment of student learning is built into the materials.

Descriptors: Assessment, Chemistry, Computer Software, Decision Making, Earth Sciences, High School, Kits, Life Sciences, Middle School, Multidisciplinary, One-Year Curriculum, Physical Sciences, Project 2061, Science, Societal Issues, Student Activities, Teacher Materials, Text, Videotape

Robert Matthews
University of Georgia Research Foundation Inc
Bond Graduate Studies Research Center
Athens, GA 30602
(404) 452-3360

9353040
$257,023
Start: 3/1/94
(29 months)

Collaborative Development of Materials to Support the Use of a New Organism for Middle School Life Science

This project proposes to develop, introduce, evaluate, and promote Fast Wasps as a versatile new living organism for life science instruction. The project intends to involve teachers in developing a minimum of 10 Fast Wasp laboratory investigations or activities and three professionally produced videotapes that will supplement the instructional activities. The project intends to demonstrate how a research scientist can serve as a model for other research scientists in improving pre-college science education. This will be done by helping teachers develop meaningful laboratory activities that meet the needs of their classes. This is a cooperative project with seven Georgia school districts who will test and evaluate the materials.

Descriptors: Biology, Laboratory Activities, Middle School, Student Activities, Videotape

Raymond Kessel
James Stuart, Louise Elbaum (Co-PIs)
University of Wisconsin, Madison
Department of Medical Genetics
750 University Avenue
Madison, Wisconsin 53706
(608) 262-1234

9252950
$542,049
Start: 4/1/92
(36 months)

Development of Elementary, Middle, and Secondary School Instructional Materials in Genetics and Biotechnology

This project develops and revises instructional materials for K–12 based on genetics activities that have been developed by classroom teachers. These 60 genetics activities (20 elementary, 20 middle school, and 20 high school) can also be integrated into existing science texts. They address genetics in several contexts. Some integrate genetics content with arts or language curricula. Others address issues of genetics in social and personal contexts. In addition to the development of genetics modules, workshops illustrating project use are held at national professional conferences to share these and other activities with teachers at the precollege level.

Descriptors: Biology, Biotechnology, Book, Content Integration, Curriculum, Elementary School, Ethics, Genetics, High School, Inquiry, Life Sciences, Middle School, Modules, Societal Issues, Supplemental, Teacher Enhancement, Workshop

Robert D. Sherwood
Vanderbilt University
512 Kirkland Hall
Nashville, TN 37240
(615) 322-7311

9350510
$1,614,999
Start: 9/1/93
(42 months)

The *Scientists in Action* Series: A Generative Approach to Authentic Scientific Inquiry

This project will design and develop a set of four video-based *Scientists in Action* episodes including a variety of hands-on activities that provide opportunities for students to work along with scientists (video-based) in using technology to solve environmental and human health problems. The video productions will be patterned after the *Adventures of Jasper Woodbury* series. The first tape will be a reshooting of the overturned tanker episode. Topics of the other three tapes will be chosen with advice from students, teachers, the Internal Review Board, and the National Advisory Committee. Software will be identified that can be linked to the video-based materials.

Descriptors: *Adventures of Jasper Woodbury* Series, Environment, Hands-On Activities, Human Health, Videotape

James LaPorte
Mark Sanders (Co-PI)
Virginia Polytechnic Institute
and State University
144 Smyth Hall
Blacksburg, VA 24061-0432
(703) 231-6480

9150085
$412,771
Start: 6/1/91
(36 months)

Integrating Middle School Technology Education Activities with Science and Mathematics Education

Seventeen activities that encourage middle school students to learn the concepts of science and mathematics by motivating them with real-world situations of interest to them are developed. The activities use design-under-constraint and hands-on technology (in contrast to hands-on science) to motivate the learning of science and mathematics. The goals are to increase the ability of students to apply concepts

of science and mathematics to real-world situations; to strengthen communications among science, mathematics, and technology teachers; and to explore the role and effectiveness of technology-based activities. The project uses teams of teachers to produce materials under the guidance of the principal investigators and science and mathematics educators. Administrators are part of the team to help work out logistical problems. The materials are disseminated by a commercial publisher.

Descriptors: Activities, Conceptual Learning, Hands-On Activities, Interdisciplinary, Mathematics, Middle School, Real-World Problems, Science, Technology Education

---

Linnea J. High
Judy Olsen (Co-PI)
Western Illinois University
900 West Adams Street
Macomb, IL 61455
(309) 295-1414

9252017
$550,161
Start: 8/1/92
(36 months)

Connecting the Past with the Future: Women in Mathematics and Science

This project develops six hour-long, interactive broadcasts for middle school students. The materials focus on contributions of females in the development and advancement of mathematics and science. Students see male and female role models in their workplaces, learn about contemporary careers and historical contributions, and participate in related mathematics activities. The video materials are distributed for further use in schools. The McDonnell Douglas Foundation, Women and Mathematics Education, Society of Women Engineers, Western Illinois University Mathematics Resource Office, and the Women's Center disseminate the materials.

Print materials are also developed for teacher and student use. These materials represent significant topics that have extended use in the classroom. Teachers receive greater background information on the role models and additional teaching ideas. The formative evaluation monitors the development and quality of the broadcasts/videotapes and their effectiveness with students. The summative evaluation analyzes data on course selection, career plans, and recall of information about role models.

Descriptors: Careers, Female, History of Science, Mathematics, Middle School, Problem Solving, Science, Supplemental, Teacher Materials, Telecommunications, Videotape

---

Mary Paden
World Resources Institute
Department of Publications
1709 New York Avenue, NW
Washington, DC 20006
(202) 638-6300

9255807
$224,482
Start: 7/1/93
(24 months)

World Resources Datascope

This project proposes to create an interactive computer program and database titled *Datascope* that is a storehouse of environmental information. The most comprehensive data now available on natural-resource and environmental issues in 146 countries of the world are used as a source of information for this program. Students are able to manipulate this database, add their own data, and seek solutions to environmental problems with the aid of developed support materials and an education software program. The project is well designed and would make a valuable environmental database available in an interactive format that students could use in solving real problems. Students, using these materials, would gain experience in data manipulation, mapping, analysis, data use and understanding. Portions of the program could be used in the social sciences equally well. The World Resources Institute, the Technical Education Research Center, and the Canadian Space Agency work collaboratively to develop a student and teacher guide for data analysis and interpretation.

Descriptors: CD-ROM, Computers, Computer Software, Data Analysis, Databases, Ecology, Environment, Environmental Science, Geography, High School, Middle School, Problem Solving, Real-World Problems, Social Sciences, Supplemental, Teacher Materials

---

Middle School Mathematics

Glenn M. Kleiman
Elizabeth D. Bjork (Co-PI)
Education Development Center (EDC), Inc
Center for Learning Technology
55 Chapel Street
Newton, MA 02160
(617) 969-7100

9054677
$4,275,468
Start: 5/1/91
(60 months)

Seeing and Thinking Mathematically

EDC—in collaboration with seven school districts, two subcontractors (EdCo and Inverness Research Associates), and a large group of consultants and advisors—develops a new mathematics curriculum that addresses the unique needs of middle school students.

This curriculum builds upon the central theme of mathematics in the human experience and focuses on students' learning to see and think mathematically. It reflects a view of learning as a process of constructing one's own knowledge, and it emphasizes the importance of the social context of learning for middle school students. It integrates the use of computer simulations, exploratory environments, and tools.

This project brings a new vision of mathematics, new types of learning experiences, and a new structure to the middle school curriculum. It also addresses the critical issues that determine whether a new curriculum is widely accepted and used well; these issues include teacher support, student assessment, classroom implementation, curriculum evaluation, and parental involvement.

Descriptors: Assessment, Computer Simulations, Inquiry Learning, Mathematics, Middle School, Multiyear Curriculum, Parental Involvement, Teacher Materials

---

Maurice Bazin
Exploratorium
3601 Lyon Street
San Francisco, CA 94123
(415) 563-7337

9450279
*$387,940
Start: 9/1/94
(17 months)

The Multicultural Science and Mathematics Snackbook

The Exploratorium Teachers Institute proposes to develop, test, and distribute three multicultural science and mathematics monographs for use in middle and high school classrooms. After extensive classroom testing, the three monographs will be revised and combined into one book for national dissemination. These publications will (1) present science and mathematics through tools and designs from a variety of world cultures and (2) provide related hands-on, investigatory activities for students. The philosophy and format of the publications will be based on the successful *Exploratorium Science Snackbook*. The initial publications will be self-published and distributed. A revised product, based upon feedback from initial users, will be published commercially. The proposed publications are designed to increase awareness of multicultural issues for all students, while making science more relevant and approachable to minority students.

Descriptors: Book, Hands On Activities, High School, Mathematics, Middle School, Minorities, Multicultural, Science, Student Activities

---

Steven Heard
Shelley Beckman, Rob Mikuriya, Jaime Escalante (Co-PIs)
Foundation for Advancements in Science and Education
4801 Wilshire Boulevard, Suite 215
Los Angeles, CA 90010
(213) 937-9911

9253003
$2,001,698
Start: 6/15/92
(30 months)

Multimedia Math Project (MMP)

The Multimedia Math Project (MMP) will create a versatile multimedia video product which motivates students, directly links the basic math principles they are learning to real-world applications, and gives educators insight into the teaching methods of Jaime Escalante and two other outstanding teachers. It will consist of multiple vignettes addressing approximately 20 math concepts and targeted at pre-algebra courses. These vignettes will help teachers answer the question "what is this math good for?". As does "Futures with Jaime Escalante," the MMP will feature numerous positive examples of minorities and women whose professional success has resulted from their math skills. The target grade levels are grades 7–9, focusing on pre-algebra mathematics instruction.

Descriptors: Careers, Female, Mathematics, Middle School, Minorities, Real-World Problems, Videotape

---

Steven Heard
Shelley Beckman, Rob Mikuriya (Co PIs)
Foundation for Advancements in Science and Education
4801 Wilshire Boulevard, Suite 215
Los Angeles, CA 90010
(213) 937-9911

9054655
$990,517
Start: 5/1/91
(30 months)

"Futures with Jaime Escalante": Motivational Mathematics Video Series Grades 7–12

This project develops videotape materials to enhance student interest in mathematics. These videos show students the world of opportunity open to those with good mathematical skills. In particular, the videos involve women and minorities, thus providing role models for women and minority students. Each video involves Jaime Escalante and people who have successfully applied mathematical skills in their chosen profession or job. The materials include teacher materials for each video. Teacher materials provide supplementary information for the teacher to use in leading discussions concerning the mathematics involved.

Descriptors: Careers, Female, Group Discussion, High School, Mathematics, Middle School, Minorities, Supplemental, Teacher Materials, Videotape

---

Franzie Loepp
John A. Dossey, Tom Fitch (Co-PIs)
Illinois State University
The Center for Mathematics, Science, and Technology (CeMast)

9252954
$1,951,275
Start: 7/1/92
(36 months)

Julian Hall 210W
Normal, IL 61761
(309) 438-3084

Integrated Mathematics, Science, and Technology (IMAST)

CeMast develops integrated materials for 7th-grade students centered around the topics of biotechnology, manufacturing, and forecasting. Each unit includes objectives, experiential learning, appropriate use of multimedia, appropriate technology, and evaluation instruments. Attention is given to preparing materials that motivate all students—especially those from groups underrepresented in technological careers—to learn the foundational mathematics, science, and technology concepts by involving them in enriched learning experiences relevant to their daily lives.

CeMast, together with teachers, develops the materials, which are then piloted, revised, field tested, published, and disseminated through a marketing plan supported by a publisher. To maximize the potential for long-range impact, systemic problems that impede the implementation of integrated materials are identified and alternate solutions proposed. Implementation materials are developed so that systemic changes can be made and the materials taught with minimal teacher development. Student performance data are gathered to determine the increase in achievement in mathematics, science, and technology.

Descriptors: Assessment, Biotechnology, ChemCom, Comprehensive Computer Software, Data Analysis, Earth Sciences, Hands-On Activities, Integrated Activities Life Sciences, Mathematics, Middle School, One Year Curriculum, Physical Sciences, Problem Solving, Real-World Problems, Science, Student Activities, Teacher Materials, Technology, Technology Education, Underrepresented Students

---

Shelley Goldman
Institute for Research on Learning (IRL)
2550 Hanover Street
Palo Alto, CA 94304
(415) 496-7900

9154119
$2,839,841
Start: 12/15/91
(36 months)

Middle School Mathematics Through Applications Project

The goal of this project is to increase the mathematics achievement levels of children by creating a new model of mathematics teaching and learning that will bring an "applications approach" to work in middle school mathematics classrooms. Based on results from an NSF planning grant, the objective is to contribute to current large-scale efforts in reforming mathematics education by examining how mathematics is connected to solving real-life design problems, how certain kinds of classroom activities help students build stronger foundations for thinking and acting mathematically, and how these kinds of shaping activities can open up access for more female, minority, and economically disadvantaged students to enter and successfully complete the high school mathematics sequence through calculus.

This project has three main components: (1) new materials and activity structures for learning mathematics in which students use simulations adapted from real application work; (2) new teaching and assessment practices that use these materials, emphasizing teachers interacting with students in collaborative working groups and helping students to identify, analyze, and reflect upon the mathematical concepts and skills, thus grounding their problems and their solutions; and (3) new ways for teachers, professionals, and educational researchers to work together. The project is a collaboration between 20 Bay-area mathematics teachers, IRL, Stanford University, and professionals in the area.

Descriptors: Assessment, Cognitive, Computers, Computer Simulations, Engineering, Ethnographic, Female, Integrated Curricula, Mathematics, Middle School, Minorities, Multidisciplinary, Multiyear Curriculum, Real-World Problems, Student Activities

---

Jerald Murdock
Interlochen Arts Academy Mathematics
Interlochen, MI 49643
(616) 276-9221

9154410
$93,767
Start: 6/1/92
(24 months)

Graphing-Calculator–Enhanced Algebra Project

This project develops instructional materials for incorporating the use of graphing calculators in algebra. The lessons and "investigations" using graphing calculators are designed for direct use by the students and include materials for the teachers to aid them in the use of materials. Transitional materials that help the student make the leap from simple calculators to graphing calculators and that provide an early introduction to experimentation in mathematics are developed. The project personnel provides in-service workshops for teachers, both during the year and in the summer. These materials are published in a monograph by the Michigan Council of Teachers.

Descriptors: Calculators, High School, In-Service Training, Mathematics, Middle School

---

Gail P. Long
Maryland Public Television
11767 Owings Mills Boulevard
Owings Mills, MD 21117
(410) 581-4105

9255782
$2,118,922
Start: 9/15/93
(48 months)

Numbers Alive!

The Numbers Alive! project models the use of number sense and provides opportunities for its practice through the production of 10 half-hour television programs for students, one program for parents and care-givers, and print materials in support of both types of programs. The targeted student audience is 5th and 6th graders. The series emphasizes number concepts and problem-solving strategies in support of the National Council of Teachers of Mathematics standards.

Descriptors: Conceptual Learning, Mathematics, Middle School, NCTM Standards, Number Sense, Print Materials, Problem Solving, Television Programs

---

William M. Fitzgerald
Glenda Lappan, Elizabeth Phillips, James T. Fey, Susan N. Friel (Co PIs)
Michigan State University
Department of Mathematics
Wells Hall
East Lansing, MI 48824-1027
(517) 353-8499

9150217
$4,809,328
Start 4/1/91
(60 months)

Connected Mathematics Project

This project develops, field tests, evaluates, and disseminates a 3-year mathematics curriculum for middle grades. The materials implement the National Council of Teachers of Mathematics Standards and engage both teachers and all students in the process of doing mathematics. The project builds on the successful development of the Middle Grades Mathematics Project, Used Numbers, and work on computers in mathematics and algebra by the principal investigators.

The major strands investigated are whole numbers, rational numbers and computation (including decimals, percents, proportion, similarity, probability, statistics, measurement, and graphs), development of algebraic concepts and symbol manipulation, statistics and data analysis, and geometry. The program's use of mathematics is rich in connections among the strands of the subject, between mathematics and other disciplines, and between the teaching activities and the interests of students. The output is a set of teacher guides, which should not require extensive in-service training, and student activities. There is also an extensive network of professional development centers which evaluates the materials and educates teachers in their use.

Descriptors: Algebra, Computers, Data Analysis, Mathematics, Middle School, Multiyear Curriculum, NCTM Standards, Numbers, Statistics, Student Activities, Symbolic Skills

---

Donald Esterling
Microcompatibles, Inc
301 Prelude Drive
Silver Spring, MD 20901
(301) 593-5151

9255715
$547,600
Start 5/1/93
(36 months)

Manufacturing Technology Learning Modules: Integrating Mathematics and Technology Education Curriculum

This project develops materials that are used with existing computer assisted design software, developed by Microcompatibles under a National Science Foundation Small Business Innovation Research grant. The software creates a block on the screen; the block can be cut and drilled to make a part by using easy to-learn commands. The student sees the part being cut on the screen and can zoom in and measure different areas of the part. Once the instructions for cutting have been completed, they can be sent by network or modem to a shop in which the part is actually made and sent to the student. This helps students learn three-dimensional visualization and integrate technology and math curricula. The materials are designed to motivate the study of mathematics in a technological context.

Descriptors: Applications, Computer-Assisted Design, Computer Software, High School, Mathematics, Real-World Problems, Technology Education, Three-Dimensional Visualization

---

Althea G. Pearlman
University Corporation for Atmospheric Research
PO Box 3000
Boulder, CO 80307
(303) 497-1000

9450248
$599,957
Start 9/1/94
(24 months)

Skymath Demonstation Project

This project involves students actively in mathematical problem solving using real-time weather data and on-line computer technology. Supplementary units (4 to 6 weeks in length) for the middle school mathematics curriculum are being developed. The units are to be cross-disciplinary. They will involve map-reading, geography, social studies, physics, and mathematics. Mathematical topics include discerning patterns, making conjectures, communicating mathematics, analyzing numerical and graphical data, measuring, symbolizing, and using scales.

Descriptors: Computers, Hands-On Activities, Interdisciplinary, Mathematics, Meteorology, Middle School

---

Beverly I. Lynds
University Corporation for Atmospheric Research
PO Box 3000
Boulder, CO 80307
(303) 497-1000

9255741
$85,894
Start 9/92
(12 months)

Project Skymath—A Planning Grant

The University Corporation for Atmospheric Research (UCAR) convened a workshop on August 10-12, 1992 to create a comprehensive plan for Project Skymath, a program based on the success of UCAR's Unidata program. Unidata distributes weather and atmospheric data to universities and colleges in a format that facilitates computer manipulation of these data; Skymath proposed to do the same for the nation's precollegiate schools. Skymath participants included nationally known and respected math educators at all levels, mathematicians, and data-transfer and materials-development specialists. This team developed classroom materials that use daily weather and climate data in the teaching of mathematics at K-12 schools with an initial focus on grades 5-8. Plans for Project Skymath included the introduction of the Skymath materials to in- and pre-service teachers across the country. Lesson plans followed the standards of the National Council for Teachers of Mathematics (NCTM). For example, students collect and record real-time data, organize, manipulate, and graph these data; and learn to explore functions that rule these graphs. Skymath helps students to become active learners, incorporating mathematics, physics, atmospheric sciences, earth and environmental sciences, and computer technology.

Descriptors: Data Collection, Mathematics, Middle School, NCTM Standards, Weather, Workshop

---

Stanley Pogrow
University of Arizona
601 Administrative Building
Tucson, AZ 85721
(602) 621-2211

9353889
$779,884
Start: 7/15/94
(24 months)

Follow-Up Grant: A Discovery-Based Mathematics Curriculum for Middle School At-Risk Students

The project focuses on helping at-risk middle school students increase their mathematics performance through the development of a new genre of software called Word Problem Processors (WPPs). A WPP enables students to create mental models of how to translate language into mathematical procedures. Students communicate in writing with an imaginary creature in the computer, and the creature responds to the language the student inputs. In addition, mathematics curriculum consisting of daily conversations that are coordinated with the software are provided. Specific mathematics concepts are introduced indirectly, through discussions of problems and issues in highly motivating computer settings. Content includes estimation, geometry, statistics, probability, graphing, measurement, ratio, proportion, percent, algebra, relations, and functions. This discovery-based mathematics curriculum supports the National Council of Teachers of Mathematics Standards, and emphasizes problem solving and problem posing in a mathematical context. Students who have low language comprehension skills raise these skill levels. Students can work individually at a computer or in groups. This project continues and augments work done during an earlier award.

Descriptors: Algebra, At-Risk Students, Computers, Computer Software, Functions, Geometry, Mathematics, Middle School, NCTM Standards, Problem Solving, Proportion, Supplemental

Stanley Pogrow
University of Arizona
Education Foundations and Administration
601 Administration Building
Tucson, AZ 85721
(602) 621-1305

9054924
$846,272
Start: 3/1/91
(36 months)

Software for a Discovery-Based Curriculum for Middle School At-Risk Students

This project, which encompasses a series of mathematics software programs for middle school students, develops skills in mathematics problem solving. It has a specific target: at-risk students in the middle school. The goal is to develop a discovery-based approach to enable students to explore the types of information necessary to discover key procedures.

Two types of software are developed: a toolkit, which enables students to construct experiments that investigate relationships among different ways of expressing numbers, and word-problem processors, which allow students to generate varieties of word problems and to speculate about the conditions under which the computer uses a particular approach to solve a given problem. In addition, lesson plans are developed and published to guide teachers in the use of the software. The resulting complete course of lessons is geared to e . ting software as well as the software developed in the project.

Descriptors: At-Risk Students, Computer Simulations, Computer Software, Exploration, Kits, Mathematics, Middle School, Problem Solving, Supplemental, Teacher Materials

Elizabeth K. Stage
Timothy E. Erickson
University of California, Berkeley
Lawrence Hall of Science
Berkeley, CA 94720
(415) 642-6000

9196242
$628,228
Start: 1/1/91
(36 months)

Investigations in Mathematics: Alternatives to Traditional Assessment

"Investigations in Mathematics: Alternatives to Traditional Assessment" will develop assessment techniques and tools that help teachers and 8th grade students focus on students' understanding of and ability to communicate about essential mathematical ideas in a wide range of realistic and imaginative situations. The Lawrence Hall of Science will assemble a group of mathematicians, mathematics educators, and mathematics teachers to create a collection of tools, called "investigations," and a process for using them which integrates assessment and instruction. In each investigation, students will be required to read, understand, conceptualize, and represent a problem situation; to use mathematical skills and knowledge to make sense of the situation; and to communicate their thinking in a form that can be understood and evaluated. Investigations will give students the opportunity to consolidate and apply their mathematical understandings to the solution of complex problems. Included in the package will be teaching suggestions for the introduction of investigations, ways to assist .dents as they work on investigations, sample scoring schemes, and ideas for giving students feedback on their work. The

investigations will focus on the most important mathematical ideas of the curriculum.

Descriptors: Assessment, Communications Skills, Conceptualization, Middle School

David A. Page
Roberta L. Dees, John T. Baldwin (Co-PIs)
University of Illinois, Chicago
Mathematics/Statistics/Computer Science
851 South Morgan, Mail Code 249
P.O. Box 6998
Chicago, IL 60607
(312) 996-3041

9154110
$1,741,513
Start: 1/1/92
(48 months)

Replacement Modules in Mathematics for the Middle Grades: Continuation of the University of Illinois, Chicago, Maneuvers with Mathematics Project

This project develops five replacement units for the middle grades. They are continuations of five previously developed modules. The modules focus on topics such as Percent and Sports, Speeds and Sizes. Each module focuses primarily on the use of scientific calculators and on open-ended questions. In addition to the materials for teachers and parents, there is a formative evaluation in the development of the material and a summative evaluation of the entire project including assessment of student learning.

Descriptors: Assessing Student Learning, Calculators, Mathematics, Middle School, Modules, Parents, Teacher Materials

Rick Billstein
James Williamson (Co-PI)
University of Montana
Department of Mathematical Sciences
Missoula, MT 59812-1032
(406) 243-2603

9150114
$3,752,020
Start: 8/1/91
(60 months)

Six Through Eight Mathematics (STEM)

The Six Through Eight Mathematics (STEM) Project develops a new curriculum in mathematics for grades 6–8, including a complete set of student materials, teacher materials, and evaluation materials. STEM is designed to provide teachers with curricular materials that are mathematically accurate, utilize calculators and computer technology, and provide students with bridges to the sciences, social sciences, and other mathematical fields. These materials are designed to integrate communication into mathematics by providing opportunities for students to use reading, writing, and speaking as tools for learning mathematics. STEM materials are problem-centered, application-based, and use technology where appropriate. Many lessons are designed to be project oriented so that students work cooperatively. In addition, new evaluation techniques are developed for use with the materials. In designing the curriculum, the project staff works cooperatively with IBM, Houghton Mifflin Publishing, Microsoft, and Texas Instruments. The materials are to be disseminated nationally.

Descriptors: Calculators, Communications Skills, Computers, Cooperative Learning, Mathematics, Multidisciplinary, Multiyear Curriculum, Problem Solving, Social Sciences, Student Materials, Teacher Materials

Thomas A. Romberg
University of Wisconsin, Madison
Wisconsin Center for Education Research
1025 West Johnson Street
Madison, WI 53706
(608) 263-4285

9054928
$1,702,780
Start: 8/1/91
(60 months)

Mathematics in Context: A Connected Curriculum for Grades 5–8

This project develops a complete mathematics curriculum for grades 5–8. The curriculum includes instructional materials, staff-development materials, and assessment materials.

The instructional materials consist of 40 units, each of about 3–4 weeks duration. They are developed in the spirit of the National Council of Teachers of Mathematics Standards, grades 5–8. A teacher's guide provides information on activities, videotape clips, and technological tools related to each unit.

The staff-development materials consist of two pieces: an in-service program and a teacher-network model. The latter component, which is designed to lend support to teachers, includes such things as electronic bulletin boards and collaborative organizations.

The assessment materials consist of instructional assessment materials and a core curriculum readiness examination to assess the students' readiness for the core curriculum as described in the grades 9–12 section of the NCTM Standards.

Descriptors: Assessment, Calculators, Computers, Elementary School, Mathematics, Middle School, Multiyear Curriculum, NCTM Standards, Networking, Student Activities, Teacher Materials, Units, Videotape

John D. Bransford
Vanderbilt University
Learning Technology Center
416 Kirkland Hall
Nashville, TN 37240
(615) 322-7311

9252990
$2,186,660
Start: 6/15/92
(36 months)

Extension of the *Jasper* Series: A Generative Approach to Improving Mathematical Thinking

This project develops six additional adventures for the *Adventures of Jasper Woodbury* series plus video extensions for each adventure and relevant print and professional development teacher materials. Included with each *Jasper* adventure is an optional piece of software that allows students to create their own adventures. This series is designed to be implemented at various levels of hardware. It is also designed to be used in conjunction with videodisk technology. The simplest level of technology is with a videodisk player and a remote; the second level is to use a videodisk player with barcode; and the

third level involves computer-based control of the videodisk with hypercard stacks and computational and graphic tools. The project has an extensive research component, which includes an analysis of the reactions to *Jasper* characters and adventures, an assessment of teachers' ideas for implementation, expanded assessments of student learning, studies of the value-added *Jasper* software, and research on the Adventure Maker.

Descriptors: *Adventures of Jasper Woodbury* Series, Assessment, Computers, Computer Software, Mathematics, Student Activities, Supplemental, Teacher Materials, Videodisk

---

James LaPorte
Mark Sanders (Co-PI)
Virginia Polytechnic Institute
and State University
144 Smyth Hall
Blacksburg, VA 24061-0432
(703) 231-6480

9150085
$412,771
Start 6/1/91
(36 months)

Integrating Middle School Technology Education Activities with Science and Mathematics Education

Seventeen activities that encourage middle school students to learn the concepts of science and mathematics by motivating them with real-world situations of interest to them are developed. The activities use design-under-constraint and hands-on technology (in contrast to hands-on science) to motivate the learning of science and mathematics. The goals are to increase the ability of students to apply concepts of science and mathematics to real-world situations; to strengthen communications among science, mathematics, and technology teachers, and to explore the role and effectiveness of technology-based activities. The project uses teams of teachers to produce materials under the guidance of the principal investigators and science and mathematics educators. Administrators are part of the team to help work out logistical problems. The materials are disseminated by a commercial publisher.

Descriptors: Activities, Conceptual Learning, Hands-On Activities, Interdisciplinary, Mathematics, Middle School, Real World Problems, Science, Technology Education

---

Linnea J. High
Judy Olsen (Co-PI)
Western Illinois University
900 West Adams Street
Macomb, IL 61455
(309) 295-1414

9252917
$550,161
Start 8/1/92
(36 months)

Connecting the Past with the Future: Women in Mathematics and Science

This project develops six hour-long, interactive broadcasts for middle school students. The materials focus on contributions of females in the development and advancement of mathematics and science. Students see male and female role models in their workplaces, learn about contemporary careers and historical contributions, and participate in related mathematics activities. The video materials are distributed for further use in schools. The McDonnell Douglas Foundation, Women and Mathematics Education, Society of Women Engineers, Western Illinois University Mathematics Resource Office, and the Women's Center disseminate the materials.

Print materials are also developed for teacher and student use. These materials represent significant topics that have extended use in the classroom. Teachers receive greater background information on the role models and additional teaching ideas. The formative evaluation monitors the development and quality of the broadcasts/videotapes and their effectiveness with students. The summative evaluation analyzes data on course selection, career plans, and recall of information about role models.

Descriptors: Careers, Female, History of Science, Mathematics, Middle School, Problem Solving, Science, Supplemental, Teacher Materials, Telecommunications, Videotape

---

High School Science

Bernard V. Khoury
Donald F. Kirwan (Co-PI)
American Association of Physics Teachers
1 Physics Ellipse
College Park, MD 20740
(301) 209-3300

9150111
$1,315,641
Start: 7/1/91
(48 months)

Just Physics...

The American Association of Physics Teachers and the American Institute of Physics develop an innovative, year-long physics course suitable for students in grades 9–12. The course consists of six thematic units—recreation, transportation, communications and information, health and medicine, home and forecasting—that revisit a few important fundamental physics concepts in a spiral approach, applying them to new, real-world contexts. The course is consistent with American Association for the Advancement of Science's Project 2061 themes, particularly materials and energy, and can be taught in 1 year or spread through 4 years. The mathematical level of students will be enhanced in accordance with the National Council of Teachers of Mathematics Standards. A constructivist approach and the use of cooperative grouping strategies are incorporated in the curriculum design. Students will be able to recognize and begin to understand broad unifying concepts of physics and technology, to gain an appreciation of science as a process, to apply the concepts to realistic problem-solving and decision making activities, and to identify and evaluate personal and societal impacts of technology. The materials are developed by teams of scientists and high school teachers with support from cognitive scientists, curriculum experts, and technology educators. Teachers will be provided with knowledge, skills, and support to make effective use of the materials.

Descriptors: Constructivist Approach, High School, NCTM Standards, One-Year Curriculum, Physics, Project 2061, Real-World Problems, Teacher Materials, Technology Education, Thematic Units

Janet A. Mattei
John Percy (Co-PI)
American Association of Variable Star Observers
25 Birch Street
Cambridge, MA 02138
(617) 354-0484

9154091
$303,943
Start: 7/1/92
(36 months)

Hands-On Astrophysics: Variable Stars in the Science/Mathematics Lab

The excitement of astrophysical research and discovery is brought into high school science and mathematics classes through a flexible set of student activities and projects on variable stars. The project includes a computerized database of 400,000 measurements of brightness of 150 variable stars in five constellations over 25 years. From this database, students can deduce properties, processes, and evolution of these stars. Students can make additional measurements and discoveries from carefully selected time sequences of 125 35mm slides or from actual measurements from the night sky. A comprehensive student manual and instructional videos make the materials self-contained and easy to use. The teacher manual enables the instructor to adapt the materials for skills, objectives, and local curricula requirements. The material can be used in a variety of contexts: traditional mathematics and science classes at both the high school and college levels, independent projects, summer institutes, and community science clubs. The material is field tested in classes and refined through workshops with teachers. A newsletter and a video about amateur astronomers are planned.

Descriptors: Astronomy, Hands-On Activities, High School, Photographs, Physical Sciences, Physics, Postsecondary, Science, Student Activities, Supplemental, Teacher Materials, Text, Videotape

Phil J. Gersmehl
Association of American Geographers
1710 16th Street, NW
Washington, DC 20036
(202) 234-1450

9150115
$519,377
Start: 7/1/91
(30 months)

US/USSR Curriculum Materials Development Project

Leading geographers from the Association of American Geographers, together with secondary school teachers, produce a curriculum materials package for use in existing and emerging social science classes in the secondary schools. The materials focus on population, patterns, economic regionalization, and political geography as factors that shape the pattern of human-environment interaction throughout the nation. The aim of these materials is a broad contextual understanding of environmental issues, with particular emphasis on the kinds of global problems that require coordinated action at the global, regional, and local levels. The materials consist of a concise geography text, a set of classroom and individual student activities, related readings, and a detailed teacher's manual. Student assessment instruments are also developed. The materials incorporate features that reflect trends in several aspects of the secondary curriculum as recommended by "Guidelines for Geographic Education," the National Council of Teachers of Mathematics Standards, and the report, "Charting a Course: Social Studies Curriculum for the 21st Century," published by the National Commission on Social Studies in Schools. Formative evaluation is conducted by an outside expert, and the Network of Geographic Alliances also plays a central role in materials dissemination and teacher enhancement.

Descriptors: Environment, Geography, High School, NCTM Standards, Social Sciences, Student Activities, Teacher Enhancement

Rodger W. Bybee
Janet Powell (Co-PI)
Biological Sciences Curriculum Study (BSCS)
Department of Biological Science
Colorado Springs, CO 80903
(719) 578-1136

9252974
$3,481,078
Start: 9/1/92
(48 months)

Biological Science: A Human Approach

The human species forms the basis for a 10th grade, activity-based biology course. The objectives of the course are to help students to understand both those characteristics that are unique to the human species and those that are shared with other living systems and to understand the place of humans in the biosphere and the consequences

of our interactions with other species and the environment on the evolutionary process. The course reflects science education reform movements and stresses understanding concepts and processes over merely learning vocabulary. The content emphasizes major biological themes as identified in curriculum frameworks: evolution, genetic continuity, patterns of organization, bioenergetics, and ecology. The course, which is designed for all students and schools, is organized around topics that concern students: the human species, the human organism, human physical performance, human life cycle, human population, and human adaption. It incorporates laboratory activities, instructional technologies, and employs modified learning cycle and modern assessment strategies. Materials include a student textbook, a student resource book, videodisks, laboratory kits, a teacher's guide, an assessment package, and an implementation guide.

Descriptors: Assessment, Biology, Environmental Science, Evolution, High School, Kits, One-Year Curriculum, Societal Issues, Teacher Materials, Text, Videodisk

---

Iris T Metts
Paul T Devine, Morris W Brooks, Catherine L Houghton, Robert H Gross, Jr., John A Bartley (Co-PIs)
Christina School District
83 Main Street
Newark, DE 19711
(302) 454-2381

9353044
$752,124
Start: 8/1/94
(40 months)

Engineered Environment Laboratory Curriculum

This project intends to develop, implement, and disseminate interdisciplinary curricula and materials based on an Engineered Environment Laboratory. These materials would provide instruction and guidance to students for recreating a local habitat. The habitat, which is to be developed in Delaware, would interface a temperate hardwood forest with an old-field agricultural system and a freshwater marsh. This habitat would serve as an experimental laboratory for the development of hands-on activities and experiences that would enable students to become aware of the role of wetlands. The proposed activities would also provide the necessary background for them to make informed decisions regarding the future of this critical habitat. Materials produced from this project would include a generic curriculum development framework and instructions for the development of an engineered environment laboratory appropriate equally to other environments such as deserts and grasslands. Materials would be designed by teachers in cooperation with the University of Delaware Instructional Technology Center and others and would be available on a variety of delivery formats

Descriptors: Environmental Science, Hands-On Activities, High School, Laboratory, Student Activities, Wetlands

---

William H Leonard
John Pennick (Co-PI)
Clemson University
Elementary and Secondary Education
201 Sikes Hall
Clemson, SC 29634
(803) 656-5129

9252892
$2,346,312
Start: 7/1/92
(54 months)

BioCom: A More Appropriate Secondary Biology Curriculum

BioCom, patterned after ChemCom, focuses on the study of a few, selected biological concepts in an environmental, technological, and community context. Students investigate an issue, discover appropriate biological principles, and apply their knowledge actively, in context, allowing them to construct personal meaning in a setting where their explanations will be revealed. Students investigate, study, and analyze what is necessary to resolve issues in topics including Waste, Energy, Population Limits, Organismal Maintenance, Population Maintenance, Behavior, and Evolution. Project 2061 themes for biology and the human organism are covered. The materials, the activities, and the ancillaries are developed by a team of scientists, biology educators, and high school teachers, guided by a national advisory board. The units are carefully pilot tested and field tested in diverse locations. The major products of the project are a student textbook (shorter than usual), a teacher edition, a loose-leaf teacher resource book with additional investigations, projection masters, test items, and a high-tech kit. The materials are to be published by Kendall/Hunt, which also supports teacher enhancement.

Descriptors: Biology, ChemCom, Evolution, High School, Kits, One-Year Curriculum, Project 2061, Real-World Problems, Science, Societal Issues, Student Activities, Teacher Materials, Text, Thematic Units, Videotape

---

Peter Yun
Walter Crouse (Co-PI)
Clinch Valley College
College Avenue
Wise, VA 24293
(703) 328-0119

9150087
$87,200
Start: 4/15/91
(24 months)

Southwest Virginia Summer Scholars Program

An effective interdisciplinary, integrated hands-on model of science instruction has been developed and used with underserved and able

high school students during the summer months. Science and writing are emphasized in addition to field research. In this project, this model is expanded upon and a source book is developed for use by others wanting to implement this type of program.

Descriptors: High School, Interdisciplinary, Underrepresented Students, Writing

Raymond Sambrotto
Columbia University
Box 20
Low Memorial Library
New York, NY 10027
(212) 280-7154

9353081
$206,439
Start: 6/1/94
(12 months)

EARTH VIEW: An interactive educational tool to explore topics in earth science and global change

This project develops an interactive, computer-based program that will promote conceptualization through student exploration of relevant scientific and societal issues in earth science. The proposed software would provide the capability to access, analyze, and model geographically based data using a state-of-the-art graphical interface and would retrieve data over a distributed computer network such as the Internet. The proposed curriculum entitled "Earth View" is to be a general model by which computer networking can be used to expand the classroom. A personalized notebook would be developed and used to guide students' exploration and would provide a site for recording findings and interpretations. This notebook would also serve as a portfolio for evaluation of learning progress. A CD-ROM would be produced for those schools which do not have direct access to an online data source or the Internet.

Descriptors: CD-ROM, Computers, Geology, Global Information System, High School, Networks, Science, Societal Issues, Technology

Sandra L. Cooper
Ralph S. Cooper, Charles E. Walker (Co PIs)
Creative Enterprises
76 Santa Ana Avenue
Long Beach, CA 90803
(310) 987-3450

9050186
$382,826
Start: 8/1/91
(36 months)

Interactive Materials to Stimulate Minorities Toward Engineering Careers

This project aims to motivate minority students to prepare for careers in science- and mathematics-based professions, especially engineering. The technical approach is to create interactive media, including both a computer program and text-based materials, to stimulate and inform students concerning the activities of professional engineers, the academic and social life in college, and course requirements for both high school and college. The combined media use an "adventure" format with many possible scenarios dependent upon the student's selection, plus humor and special effects (e.g., computer sound and animation) to sustain interest. Examples relate the secondary school course content to engineers' practices. The program is being conducted in conjunction with California State University, Long Beach, MESA (minority outreach) and MEP (Minority Engineering Programs), and in conjunction with Compton middle schools (grades 6–8). A computer simulation with text accompaniments and teacher's guides has been completed and field tested in the junior high schools. The success of this model will eventually lead to a range of materials for economical, nationwide dissemination and application on many educational levels for minorities, women, persons with disabilities, and other special and general populations.

Descriptors: Animation, Careers, Computer Simulations, Computer Software, Engineering, Female, High School, Mathematics, Middle School, Minorities, Physically Impaired, Science, Supplemental, Teacher Materials, Urban School

Robin Gregory
Decision Science Research Institute
1201 Oak Street
Eugene, OR 97401
(503) 485-2400

9450237
$119,941
Start: 9/1/94
(11 months)

Development of an Effective Decision-Skills Curriculum for Secondary School Students

Improvement of the decision-making skills of secondary school students is an important component of the education reform movement. It is also a component in the education of workers for a competitive workforce. In a previously funded, exploratory grant, modules were developed for a variety of disciplines in which the content was taught by also emphasizing decision skills. This project builds upon that base to further develop, test, and evaluate content-specific modules which teach the eight decision skills. Decision skills are interwoven with subject-based material. Students assume the role of active decision makers faced with problems confronting scientists: interpreting conflicting outcomes, understanding sources of uncertainty, knowing when to go ahead despite a lack of information and when it is necessary to seek out additional information, distinguishing personal from professional values and knowing how best to work with a team of colleagues possessing diverse skills, all of whom may see the world a little differently. The project is undertaken with teachers in Eugene, Oregon, and other locations. Results to date indicate that students and teachers find the materials engaging and that learning science becomes more relevant. The materials include discipline-specific modules, which link decision-making skills and which serve as an introduction to both the science and the decision-making, and a decision-skills handbook and video for teachers to see how to augment traditional science teaching.

Descriptors: Decision Skills, Environmental Science, High School, Modules, Multidisciplinary, Physical Sciences, Social Sciences, Student Activities, Teacher Materials, Videotape

Robin Gregory
Decision Science Research Institute
1201 Oak Street
Eugene, OR 97401
(503) 485-2400

9154382
$339,026
Start: 2/15/92
(24 months)

Improving the Decision-Making Skills of Secondary School Students

Decision science specialists at Decision Science Research Institute, together with teachers at the Eugene (Oregon) 4-J School District, develop 10 to 12 modules focusing on teaching decision-making skills to secondary school students. The project focuses on decision making in science areas related to human health and to the environment. Students learn to represent decision opportunities in terms of expected consequences of different choices and the perceived desirability of those choices. The material presents the four themes of decision making—thinking, structuring, uncertainty, and tradeoffs—and demonstrates that values are important, that decision making is purposeful, that there are future events that cannot be controlled or predicted, and that different choices result in different benefits, risks, and costs. Instructional modules are developed and evaluated on the basis of their success in encouraging better decisions as well as their ability to enhance decision-making skills in science domains. Dissemination is conducted with assistance from the International Society for Technology in Education.

Descriptors: Decision Making, Environmental Science, High School, Human Health, Modules, Science, Societal Issues, Student Activities, Supplemental, Teacher Materials, Thematic Units

---

Jacqueline Miller — 9255722
Judith Sandler (Co-PI) — $1,196,430
Education Development Center (EDC), Inc — Start: 5/1/93
55 Chapel Street — (36 months)
Newton, MA 02160
(617) 244-3436

Creating a New Biology Curriculum: A Collaborative Approach

This modular, 10th-grade biology curriculum redefines biology instruction so that the teaching of biology encompasses new concepts and technologies, is socially relevant, is accessible and stimulating, and builds on the natural connections between biology, health-related issues, and society. Taken together, the six modules constitute a complete, interactive, hands-on, and inquiry-based curriculum, in which information is integrated into a coherent and related set of concepts which are relevant to students' lives and experiences. The modules integrate concepts and themes of biology in topics such as infectious diseases, cancer, plants as food and medicine, habitat growth, mitochondrial Eve, and your body, yourself. The biological concepts of cell and molecular biology, evolution, energy and metabolism, development, reproduction and heredity, ecology, and human biology are woven into themes of systems and interactions, energy and matter, evolution and patterns of change, diversity and variation, and structure and function. Each module contains a teacher's guide, student materials, and performance assessment strategies and instruments. A Curriculum Planner provides assistance in implementing the curriculum and also a set of recommendations for program adopters for introducing and implementing the materials into the school system. The materials are developed by EDC in collaboration with distributors, evaluators, teachers, and school districts.

Descriptors: Assessment, Biology, Conceptual Learning, Hands-On Activities, High School, Modules, Real-World Problems, Societal Issues, Teacher Materials

---

Bennett Glotzer — 9150092
David Benjamin, Richard E. Berg, Jearl D. Walker (Co-PIs) — $1,117,000
Education Group, Inc — Start: 5/1/91
1235 Sunset Plaza Drive — (18 months)
Los Angeles, CA 90069
(213) 659-8831

The Video Encyclopedia of Physics Demonstrations

Approximately 600 demonstrations are recorded on videodisk for use in teaching introductory physics by high school and college teachers and at informal science programs. The experiments are chosen mainly from the collections at the University of Maryland and the University of Washington by high school teachers. The use of two-channel audio enables teachers to use the narration supplied or use their own. Transcripts of the narration, notes on construction of demonstrations, and information about the demonstrations accompany the videodisks. The demonstrations are keyed to popular physics texts and a search routine is available. The disks are distributed commercially.

Descriptors: Demonstrations, High School, Physics, Teacher Materials, Videodisk

---

Edgar Garbisch — 9353030
Environmental Concern, Inc. — $19,694
P.O. Box P — Start: 5/15/94
St. Michael's, MD 21663 (16 months)
(410) 445-9620

Wetland Creation, Restoration, and Enhancement Guide

The intent of this project is to prepare a guidebook, for students and teachers of grades 7–12, that will encourage, facilitate, and guide the creation, enhancement, and restoration of wetlands. The guide is expected to be about 150 pages long and will be divided into two parts. Part I will provide information on the common wetland types with integrated learning activities. Part II will include information on identifying potential sites for implementing the project and will include the information necessary to achieve these objectives. The guide will also include information on ecological functions, hydrologic regimes, and plant communities of wetlands. It will provide an alternative for hands-on projects that will result in a schoolyard habitat well suited for student monitoring, research, and instructional activities. An existing urban wetland restoration project will be selected to field test this project.

Descriptors: Book, Ecology, Environmental Science, Hands-On Activities, High School, Middle School, Projects, Teacher Materials, Wetlands

---

Maurice Bazin
Exploratorium
3601 Lyon Street
San Francisco, CA 94123
(415) 563-7337

9450279
$387,940
Start: 9/1/94
(17 months)

The Multicultural Science and Mathematics Snackbook

The Exploratorium Teachers Institute proposes to develop, test, and distribute three multicultural science and mathematics monographs for use in middle and high school classrooms. After extensive classroom testing, the three monographs will be revised and combined into one book for national dissemination. These publications will (1) present science and mathematics through tools and designs from a variety of world cultures and (2) provide related hands-on, investigatory activities for students. The philosophy and format of the publications will be based on the successful *Exploratorium Science Snackbook*. The initial publications will be self-published and distributed. A revised product, based upon feedback from initial users, will be published commercially. The proposed publications are designed to increase awareness of multicultural issues for all students, while making science more relevant and approachable to minority students.

Descriptors: Book, Hands-On Activities, High School, Mathematics, Middle School, Minorities, Multicultural, Science, Student Activities

Jane Dillehay
Gallaudet University
Department of Biology
Hall Memorial Building
800 Florida Avenue, NE
Washington, DC 20002
(202) 651-5385

9150156
$517,786
Start: 7/15/91
(36 months)

Microcomputer Technology for Strengthening Life Science Instruction for Deaf and Hearing Students

The main objectives of the project follow two themes: (1) the collection and assessment of several hundred life science microcomputer software programs for use by hearing-impaired students, including examination of the differences and similarities between hearing and hearing-impaired students using the same programs, and (2) the dissemination of information about the results of these assessments. These objectives are closely associated with the objective of increasing the population of qualified hearing-impaired people going into fields of science.

By encouraging the use of microcomputers in the life sciences, students in the 1,000 institutions for the hearing impaired and other programs benefit from the use of good-quality software. The project uses hearing-impaired students as subjects and evaluators. The assessments are made at Gallaudet University, selected schools for the deaf, and some mainstreamed hearing-impaired programs. The assessments not only select the best programs for the hearing impaired but also determine if the results may be generalized from the deaf to the hearing population. As data are gathered on these assessments, a wide dissemination effort provides information to the science-education community on preferred software programs for both the hearing-impaired and the general populations.

Descriptors: Assessment, Biology, Computer Software, Hearing Impaired, High School, Life Sciences, Science

Sharon S. Hillery
Georgetown Visitation Preparatory School
Department of Science
1524 35th Street, NW
Washington, DC 20007
(202) 337-3350

9154104
$18,071
Start: 9/1/91
(24 months)

Stimulating Interest in Science Among Young Women in a College Preparatory Curriculum

This project studies the effect of "ChemCom Instruction," along with the use of locally made videotapes on applications of chemistry, on women's interest in pursuing advanced study in science at the precollege level. The study is part of an activity needed to determine if a different approach to chemistry (other than the usual or traditional college preparatory approach) impacts students' attitudes toward science and their subject-matter competence.

Descriptors: Applications, ChemCom, Chemistry, Female, High School, Videotape

Helane Selin
Hampshire College
Harold F. Johnson Library
Amherst, MA 01002
(413) 549-4600

9154088
$20,095
Start: 7/1/91
(12 months)

Comparative Scientific Tradition: A Bibliography of Works on Non-Western Science

An annotated bibliography of more than 1,200 items is produced which covers Asian, African, Islamic Middle East, Latin American, and precontact North American science and medicine. This bibliography is of value to teachers, students, and curriculum developers who want to include examples of the cultural relativity of the scientific enterprise. The bibliography is arranged by location, with an extensive subject index. The bibliography is published and the ideas disseminated to teachers through networks, partnerships, journals, and talks.

Descriptors: Bibliography, International, Medicine, Multicultural, Resource Materials, Science, Teachers

Irwin Shapiro
Ursula Marvin, Darrel Hoff (Co PIs)
Harvard University
Holyoke Center 458
Cambridge, MA 02138
(617) 495-1000

9252887
$227,844
Start: 5/1/92
(12 months)

Project IMAGE: Investigative Materials about Global Environments

All global environmental issues can be linked to an earth science topic. Existing earth science courses, therefore, provide an efficient route for reaching a significant number of the nation's students. A survey of 1,000 members of the National Earth Science Teachers Association yielded a 49 percent response, with 97 percent of the respondents favoring the use of imagery-based activities in their courses. Based on these and other data, researchers conclude that it is likely that these materials will reach 750,000 students per year, greatly increasing the awareness of the nation's next adult generation to the environmental issues that they will face. Using satellite and high altitude imagery, the project will develop 15 hands-on modules that will confront students with the problems and challenges of our global environment. Twenty master earth science teachers will work with the staff on the development of the activities during each of three summer institutes. These teachers will field test the materials for commercial publication during two academic years. A series of implementation workshops in cooperation with the commercial publisher to disseminate these materials will be held.

Descriptors: Earth Sciences, Global Environmental Issues, Hands On Activities, Student Activities

David M. Winch
Kalamazoo College
Department of Physics
1200 Academy Street
Kalamazoo, MI 49007
(616) 383-8400

9252953
$411,780
Start: 8/1/92
(36 months)

Doing and Thinking Physics at the Secondary Level

Physics Cinema Classics, completed in 1991, is a set of videodisks that contain repurposed clips from many of the classical films of physics demonstrations. Topics covered include mechanics, heat, waves, electricity and magnetism, conservation laws, and modern physics. The multimedia package is designed to be used in a variety of educational situations ranging from classroom discussions and data collection for laboratory experiments to interactive computer-controlled videodisk learning groups. The learning groups particularly meet the needs of concrete learners. Twenty-four high school teachers have held workshops attended by more than 1,000 teachers who learned to use the videodisk materials. Some of the workshop teachers share their "tricks of the trade" in a comprehensive set of lesson guides for the videodisk to make them useful to the underprepared teacher in the classroom as requested by the workshop participants. The lesson guides contain an overview of the disk, physics concepts, teaching ideas, questions, discussion suggestions, quizzes, laboratory exercises, and instruments to assess student understanding of concepts. The lesson plans are indexed to the videodisks with bar codes.

Descriptors: Demonstrations, High School, Misconceptions, Physics, Science, Student Activities, Supplemental, Teacher Materials, Videodisk

Thomas Manney
Monta Manney (Co-PI)
Kansas State University
Department of Physics
Anderson Hall
Manhattan, KS 66506
(913) 532-6222

9252889
$256,189
Start: 9/1/92
(24 months)

Materials for Using Yeast Genetics and the Effects of Radiation

This project develops instructional materials in genetics and yeast biology that can be integrated into existing secondary biology courses. This project is an outgrowth of a series of teacher-enhancement workshops that led to the establishment of a network of science teachers and research scientists. Kits of materials, classroom protocols, sup-

porting text, videotapes, and computer software focusing on experiments using modern techniques of yeast biology are developed for in-service and classroom use. Students are stimulated by their own ability to generate and investigate questions that concern them directly—on, for example, the topics of inheritance, biotechnology, radiation effects, mutations, cancer, and nutrition. Through experimentation, investigation, and inquiry, students are challenged to learn the foundations of fundamental biological concepts. Ancillary materials include a teacher guide, an electronic bulletin board system, and videotapes on techniques.

Descriptors: Biology, Biotechnology, Computer Software, Electronic Bulletin Board, Genetics, High School, Inheritance, In-Service Training, Kits, Microorganisms, Mutation, Radiation Effects, Teacher Materials, Teaching Strategies, Videotape, Yeast

Stuart A. Naquin
Los Angeles County Museum of Natural History
Department of Earth Sciences
900 Exposition Boulevard
Los Angeles, CA 90007
(213) 744-3414

9054653
$145,259
Start: 7/15/91
(24 months)

Plants in Evolution: The Fossil Record

"Plants in Evolution: The Fossil Record" involves the development of a wall chart and ancillary materials that depict plant development over geological time. This material fills a void in the available materials designed to tell the story of organic evolution. Prior attention among paleontologists has been largely devoted to the evolutionary development of animals. With the synthesis and use of the project materials, a more complete view of the changing array of life is available. An accompanying teacher's guide is designed to assist secondary school teachers in the proper use of the chart, provide background material, and coordinate the chart content with the type of textbooks that are usually available for high school biology.

Descriptors: Biology, Geology, High School, Plant Evolution, Science Supplemental, Teacher Materials, Wall Chart

Donald Esterling
Microcompatibles, Inc
301 Prelude Drive
Silver Spring, MD 20901
(301) 593-5151

9255715
$547,600
Start: 5/1/93
(36 months)

Manufacturing Technology Learning Modules: Integrating Mathematics and Technology Education Curriculum

This project develops materials that are used with existing computer-assisted design software, developed by Microcompatibles under a National Science Foundation Small Business Innovation Research grant. The software creates a block on the screen; the block can be cut and drilled to make a part by using easy-to-learn commands. The student sees the part being cut on the screen and can zoom in and measure different areas of the part. Once the instructions for cutting have been completed, they can be sent by network or modem to a shop in which the part is actually made and sent to the student. This helps students learn three-dimensional visualization and integrate technology and math curricula. The materials are designed to motivate the study of mathematics in a technological context.

Descriptors: Applications, Computer-Assisted Design, Computer Software, High School, Mathematics, Real-World Problems, Technology Education, Three-Dimensional Visualization

Michael S. Isaacson
Patricia G. Calarco (Co-PI)
Microscopy Society of America
P.O. Box MSA
204 Woods Hole Road
Woods Hole, MA 02543
(607) 255-4302

9355777
$15,000
Start: 9/15/93
(14 months)

Project MICRO: Microscopy in Curriculum—Research Outreach

This project is to do the research and development necessary to prepare trial instructional materials on microscopy and microscopes, how they work, and how they are used to answer questions in different fields of science in K–12 schools. The intent of this proposal is to develop a preliminary teaching guide and kit (a test module) that will provide an integrated constructivist approach to science learning by using the microscope to acquire knowledge in life, earth, and physical sciences. The materials will be developed in collaboration with the Lawrence Hall of Science in Berkeley, California. A unique opportunity is available to test the materials with the Excellence in Teaching Elementary Science (EXCITES) Program within a National Science Foundation funded project to be held at the University of California at Davis during the summer of 1993. The project includes a follow-up fall workshop for revisions and additional development, with continued participation and testing by the EXCITES teachers in the summers of 1994 and 1995. This phase of the project will culminate with a curriculum guide, which has been tested for 3 years and is ready for national distribution.

Descriptors: Constructivist Approach, Elementary School, High School, Kits, Microscopy, Middle School

Mary L. Bellamy
National Association of Biology Teachers
11250 Roger Bacon Drive #19
Reston, VA 22090
(703) 471-1134

9154112
$275,124
Start: 4/1/92
(36 months)

Teaching Hands-On Investigative Biology in High School "On a Shoestring"

There is a strong need for the inclusion in high school biology courses of more hands-on investigative activities that can be implemented with little or no cost. This project develops and disseminates a laboratory manual to meet this need. The objectives of the project are to provide teachers with activities that are effective in teaching biology as a process rather than a collection of facts and that reduce the cost of teaching process-oriented biology. Activities cover the topics

found in most state frameworks: bioenergetics, ecology, animal and plant anatomy and physiology, genetics, microbiology, cell biology, and biochemistry. Each activity has students ask a question and predict, test, and explain an answer. Experienced high school teachers participate in the writing and field testing of these activities, as well as modifying them to accommodate the needs of special populations including the physically disabled, gifted, and disadvantaged. The teacher developers are committed to conducting in-service workshops at the national, state, and local levels. The materials include directions for students and a more extensive teachers' manual which provides safety tips, tables matching the activities to commonly used high school texts, and background on the pedagogical strategies employed.

Descriptors: Biology, Hands-On Activities, High School, Laboratory, Physically Disabled, Science, Student Activities, Supplemental, Teacher Materials

Robert J. Beichner
North Carolina State University
Department of Physics
Raleigh, NC 27695-8208
(919) 515-2521

9154127
$153,688
Start: 7/1/92
(24 months)

VideoGraph Development Project

VideoGraph is an instructional tool created for use in introductory physics laboratories at the high school and college levels. It allows students to videotape motion events and, using the graphing capabilities of a microcomputer, simultaneously to examine and analyze the motion. In this revision of the initial software package, which received the Ohaus award in 1989, the developers are enhancing the original capabilities of the program, by supplying higher quality color images and support for access to videodisks. In addition, the enhanced software allows students to save previously recorded events or even simulated microworlds in which the laws of motion are preprogrammed into the system. Studies are conducted to facilitate the integration of the tool into traditional classroom, laboratory, and homework activities. A previously developed test of student skills in motion graph interpretation is refined. Observational schemes and alternative assessment methods are planned to verify that the materials have an impact on student understanding.

Descriptors: Assessment, Computer Software, Data Analysis, High School, Physics, Postsecondary, Real-World Problems, Science, Supplemental, Videodisk, Videotape

Harriett S. Stubbs
Steven Businger, Walter Heck (Co-PIs)
North Carolina State University
Air Resources Research Consortium
1509 Varsity Drive
Raleigh, NC 27606
(919) 515-3311

9150001
$1,393,738
Start: 5/15/91
(48 months)

GLOBE-NET: Changes in the Global Environment

New instructional materials that incorporate scientific research on global environment changes are developed for grades 4–12, to be infused into ongoing curricula. The program capitalizes on 10 years experience in the development, publication, and dissemination of materials on air-quality issues and the network already established between scientists, educators, teachers, and students. GLOBE-NET creates, evaluates, and prepares materials that are bias-free and scientifically and educationally sound. These materials take into account findings of research scientists in content areas and current research on how students learn science.

These materials are designed to be infused into existing and established courses of study in life, earth, physical, environmental sciences—in biology, chemistry, physics, and other science curricula. Thirty units are developed on topics including acid rain, global warming, atmospheric pollution, and ozone depletion, as each relates to scientific concepts in biodiversity, microbial respiration, physics, chemistry, and meteorology. By dealing with global environmental changes, these materials provide hands-on experiences, cooperative and inquiry learning, and other research-based strategies. The materials are to be published by Carolina Academic Press and disseminated by Carolina Biological Supply Company and others.

This project translates and transfers the most current information on this vital topic to teachers, to students, and ultimately to the general public. GLOBE-NET helps teachers, students, and parents learn more about science and is intended to help create an informed citizenry that is cognizant of scientific issues of major international concern. Cooperation between science education and the various science departments at North Carolina State University and science education at the University of Minnesota provides the expertise and breadth necessary for the project.

Descriptors: Biodiversity, Chemistry, Cooperative Learning, Elementary School, Global Change, Hands-On Activities, High School, Inquiry Learning, Interdisciplinary, Meteorology, Microbial Respiration, Middle School, Modules, Multidisciplinary, Parents, Physics, Research, Science

R.P.H. Chang
Northwestern University
633 Clark Street
Evanston, IL 60208
(312) 491-3741

9353833
$1,797,779
Start: 5/1/94
(22 months)

Materials World Modules

The "Materials World Modules" constitute a series of materials science and technology kits designed to supplement existing mathematics and science curricula in high schools. The modules close the gap between frontiers of research and science in classrooms, providing open-ended experiences for both students and teachers. Nine modules cover basic materials systems, materials and society, and materials conservation and the environment. The modules provide students with hands-on experiences in design, synthesis, and evaluation of materials. The concepts of mathematics and science are reinforced in the application of materials science and technology to product development and manufacturing. Each module includes a self-contained experimental kit, teacher and student manuals, a videotape showing how experiments are conducted—including safety instructions—and a software package for data analysis and further modeling of the

experiment. The products are developed by professors in the Materials Research Center at Northwestern working with educators and high school science, mathematics, and technology teachers. A central electronic databank on materials will be maintained at the Materials Research Center.

Descriptors: Applications, Book, Chemistry, Computer Software Databases, Hands-On Activities, High School, Kits, Laboratory, Materials Science, Mathematics, Modules, Physics, Science, Teacher Materials, Technology Education, Videotape

John Kelly
Recording for the Blind
20 Roszel Road
Princeton, NJ 08540

9252918
$289,115
Start: 7/1/93
(36 months)

Access to Science Materials for Print-Disabled Students

A Comprehensive Listing System is created to increase the amount of mathematics and science materials available in alternate formats including braille, large print, recorded, and electronic form in Canada and the United States for blind and print-disabled students in grades 3–14. Four major organizations serving print-disabled persons in North America are adding their bibliographic information to both the APH-CARL and UNION national databases, major databases serving Library of Congress users and institutions serving the visual-impaired and print-disabled. The collaborative also invites more than 400 small publishers and colleges with Disabled Student Services (DSS) Offices on their campuses to contribute other titles not presently included on the database. Materials are available in several languages to accommodate users' needs. As a part of this project, Recording for the Blind (RFB) provides training to DSS offices on RFB standards for recording science and mathematics materials to ensure uniform quality. They also train users, educators, and librarians on the new systems to increase use and minimize problems associated with the transition to college by print-disabled students.

Descriptors: Braille, Databases, Elementary School, High School, Language, Mathematics, Middle School, Postsecondary, Print-Disabled Students, Science, Visually Impaired

Diane Resek
Lynne K. Alper, Sherry Fraser, Daniel Fendel (Co-PIs)
San Francisco State University Foundation, Inc.
Department of Mathematics
San Francisco, CA 94132
(510) 658-6400

9255262
$9,059,941
Start: 9/1/92
(42 months)

Interactive Mathematics Project

This project builds on Phase I of the Interactive Mathematics Project. In Phase I, a new 3-year high school mathematics curriculum that embodies the National Council of Teachers of Mathematics Standards was developed, pilot tested, and field tested for 2 years with diverse populations. This new secondary mathematics curriculum eliminates tracking completely and has proven to be effective with all students at all levels. Phase II builds on the work of Phase I by developing a 4th year curriculum; reexamining and then revising all 3 years with the goal of improving continuity; writing supplementary materials to allow greater teacher flexibility in meeting the wide range of student needs; conducting a thorough evaluation of the effectiveness of the curriculum; assessing the various models of teacher inservice; and disseminating the program widely through large regional centers.

Descriptors: High School, NCTM Standards

Barbara Becker
Southwest Regional Laboratory
4665 Lampson Avenue
Los Alamitos, CA 90720
(310) 598-7661

9450235
$1,796,038
Start: 9/1/94
(36 months)

Making Scientific Concepts Come Alive Through Historical Dramatization and Active Student Learning Strategies: A History-of-Science Approach to High School Physical Science

The Southwest Regional Laboratory proposes to develop, produce, field-test, refine, evaluate, and disseminate a series of eight instructional modules for secondary school physical science or general science classrooms. Each module builds upon a videotaped portrayal of a selected episode in the history of science—a history that is rich in conceptual challenge, conflicting points of view, and cultural context. The units will include statics, kinematics, dynamics, electricity and magnetism, heat, light, the structure of matter, and modern problems in physical science. Some of the portrayals will include building the Brooklyn Bridge, Galileo's observations of falling bodies, Emilie du Chatelet and Voltaire's studies of collisions, Count Rumford's experiments with heat, Newton's studies of optics, and Marie and Pierre Curie's experiments with radiation. Issues of stability and change, scale and structure, and systems and interactions will be central to the development of the materials for each unit. The materials should motivate students who have shown little interest in science, challenge their conceptions of the structure and workings of the physical world, and build greater understanding of the process and culture of scientific activity. The videos are supplemented with student reading selections with both excerpts from original documents and modern interpretive text. Protocols for group and individual projects including cooperative learning activities, student presentations, and laboratory investigations; teacher guides for class discussion and debate are also provided. The videos are produced by a local television station, KCET; evaluation is carried out at the Southwest Regional Laboratory.

Descriptors: Cooperative Learning, High School, History of Science, Modules, Physical Sciences, Teacher Materials, Videotape

R. Stephen Berry
Telluride Summer Research Center
P.O. Box 2255
Telluride, CO 81435
(619) 698-2167

9255709
$21,540
Start: 7/15/92
(12 months)

Bringing the Arts into the Sciences

This project develops prototype materials bringing the methods of the graphic, plastic, and dramatic arts to the teaching of sciences—three topics in science which are common to the experience of middle school or high school students and are topics of current research in science. The materials are for teachers to implement in classes the following year. The materials have input from students in a separate, concurrent summer program at the same location. The participants are teachers and MacArthur Fellows. The MacArthur Foundation co-funds the workshop. The results of the workshop may result in the production of more materials using the methods of the graphic arts in the study of science.

Descriptors: Art, High School, Middle School, Science, Thematic Units, Workshop

Prassede Calabi
Technical Education Research Center (TERC), Inc
Science Center
2067 Massachusetts Avenue
Cambridge, MA 02140
(617) 547-0430

9252981
$1,377,077
Start: 7/1/92
(30 months)

The Changing Global Environment: An Investigative Curriculum

Worldwide, there is a great and justifiable concern about global climate and environmental change; in the United States there is also justifiable concern over lack of science literacy. Both issues are addressed through the development of this curriculum. This project develops extensive modules on three ecological topics designed as a second science course for high school students. The course assumes that most students will have had a biology course; however, no prerequisites, such as chemistry will be required. The module topics are Carbon and Energy, Nitrogen, and Water. These curriculum materials build on the sophisticated, low-cost monitoring technology already developed by TERC. Conceptually, they use a constructivist approach (hands-on, active learning, including research) to illustrate the principles of systems and classical ecology. The curriculum addresses several important concerns in science education and empowers students to understand the dynamic and interactive nature of ecosystems. The modules are ecologically oriented, integrated with several other sciences, and developed for the upperclass-level high school student. The materials are designed to be integrated into existing curricula.

Descriptors: Biomes, Constructivist Approach, Earth Sciences, Earth Systems, Ecology, Ecosystems, Environment, Global Change, Hands-On Activities, High School, Integrated Curricula, Modules, Science, Technology

David Crismond
Technical Education Research Center (TERC), Inc
2067 Massachusetts Avenue
Cambridge, MA 02140
(617) 547-0430

9252894
$656,332
Start: 10/1/92
(18 months)

Technology for Science

A series of design challenges is developed to motivate high school students of all abilities to study science in the context of practical problem solving. Students research, design, construct, and evaluate solutions to practical problems that intrigue them. The challenges draw on information from across the range of traditional science topics. Solutions arise from group discussion and information analysis. These materials augment and consolidate science learning and, more importantly, generate process and practical skills, which are transferable to other circumstances. Such practical skills include team work, information gathering and processing, evaluation, and application of knowledge to practical situations. Sample assessment strategies for working with groups of students of diverse abilities are developed. To help teachers and students find feasible solutions, a "Source Book" is produced. In addition, a teacher resource guide, suggesting sources of materials, giving technical advice, and linking the challenges to science topics, is provided.

Descriptors: High School, Physical Sciences, Problem Solving, Real-World Problems, Science, Student Activities, Supplemental, Teacher Materials, Technology Education, Text

Keith Finkral
R. Todd, T. Hughes (Co PIs)
Trenton State College
School of Technology
3 Armstrong Hall
Trenton, NJ 08650-4700
(609) 530-7600

9450249
$766,368
Start: 10/1/94
(48 months)

Professional LINKS Project

Instructional materials that integrate mathematics, science, and technology education are greatly needed. This project produces several instructional packages for secondary school students; the packages are consistent with the standards from each of the disciplines. The units are published as supplements in journals, such as *TIES Magazine*, *The Technology Teacher*, *The Mathematics Teacher*, and *The Science Teacher*, to reduce the lead time from development to

use. They are developed in a collaborative effort among teachers, subject specialists, and practitioners from science and industry. Local and national support is available to help teachers and groups of teachers use the materials. The research and evaluation component measures the impact of the units and provides models for increased use. The products include the units, teacher guides for use of the materials, and support via electronic means. Themes to be engaged include science and technology of sports, biotechnology, music, and fire-prevention and control systems.

Descriptors: Elementary School, Hands-On Activities, High School, Mathematics, Middle School, Multidisciplinary, NCTM Standards, Science, Student Activities, Teacher Materials, Technology Education

Richard Hudson
Greg Sales, David Heil (Co-PIs)
Twin Cities Public Television
KTCA Science Unit
172 East Fourth
St. Paul, MN 55101

9255777
$446,302
Start: 5/1/93
(18 months)

Newton's Apple Multimedia Collection

This project is to develop "Newton's Apple Multimedia Collection" from their unique collection of multimedia-based science instruction materials built from the successful PBS series. These materials are designed to stimulate creativity and improve the quality of teaching and learning for all grade levels. This pilot project includes three videodisks of 25 to 30 segments selected from over 200 in the areas of physical, life, and earth sciences. Technology education is included in many of the video segments and addressed in greater detail in the printed support materials. The segments, which are each 5 to 10 minutes long, supplement active classroom learning. The program includes the development of video teacher workshops, printed teacher support materials and computer software. The videodisks are produced in Spanish and English, and there is also a videodisk version for the hearing impaired. This project has a well-documented rationale on conceptual change, curriculum development models, and effectiveness of videodisk technology and television usage.

Descriptors: Computer Software, Earth Sciences, Elementary School, Hearing Impaired, High School, Interdisciplinary, Life Sciences, Middle School, Multimedia, Physical Sciences, Spanish, Supplemental, Teacher Materials, Teachers, Technology Education, Videodisk

Carl R. Pennypacker
University of California, Berkeley
Space Sciences Laboratory
Berkeley, CA 94720
(510) 486-3235

9252915
$1,269,900
Start: 8/1/92
(36 months)

The Hands-On Universe Project

This project develops eight supplemental investigations in which students analyze astronomical images taken by remote telescopes using charge-coupled device detectors. Current and past images are to become available from the Automated Supernova Search, which takes 500 images per clear night. The analysis is done in the classroom using IBM-compatible image processing software developed at the University of California, Berkeley, for research work. The activities, intended for high school astronomy, physics, or physical science courses, provide hands-on investigations coupled with an in-depth experience of engaging in science research using powerful technological tools. Telecommunications link students, teachers, and professionals in a genuine collaborative and apprenticeship-style interaction that can lead to original research. The activities, generated by professional astronomers and teachers, include investigations of the mass of Jupiter by measuring the motion of one of its moons, spatial dimensions of the solar system, collaborative searches for varying sources, and plotting light curves and distance to distant objects. Materials include an introductory video, student materials, and software for students to conduct their own image-processing activities.

Descriptors: Astronomy, Computer Software, Data Analysis, Hands-On Activities, High School, Physics, Postsecondary, Science, Supplemental, Technology, Telecommunications, Videotape

Herbert Thier
University of California, Berkeley
Lawrence Hall of Science
Berkeley, CA 94720
(510) 642-8718

9252906
$3,191,414
Start: 10/1/93
(48 months)

Issues-Oriented Science for Secondary School

The Science Education for Public Understanding Program (SEPUP) is composed of two 1-year courses: a more concrete course for middle school and a course emphasizing global issues for high school. The courses stress issues-oriented science and the use of scientific evidence and risk–benefit analysis in making decisions. These courses continue the emphasis of the Chemical Education for Public Understanding Program (CEPUP) on societal issues involving the use of chemicals, and they expand the scope of the program by dealing with other issues in life, earth, and physical sciences and in technology. The eight new modules cover many of the large themes of science proposed in Project 2061 along with issues-oriented themes such as evidence-based decision making, uncertainty and controversy, and science and social systems. Course materials stress students as active participants in doing science with the goal of developing independent thinkers able to make evidence-based decisions about issues in science and technology. Materials include a teacher resource book, a student text, project and extension activities, kits, videotapes, and software. Assessment of student learning is built into the materials.

Descriptors: Assessment, Chemistry, Computer Software, Decision Making, Earth Sciences, High School, Kits, Life Sciences, Middle School, Multidisciplinary, One-Year Curriculum, Physical Sciences, Project 2061, Science, Societal Issues, Student Activities, Teacher Materials, Text, Videotape

Mark B. Dolson
University of California, San Diego
CRL-0126
9500 Gilman Drive
La Jolla, CA 92093
(619) 534-2678

9054644
$366,534
Start: 1/1/91
(24 months)

Learning Mathematics and Science Through the Exploration of Sound

Computer-based materials are created to enable high school students to develop specific concepts in advanced mathematics and trigonometry through guided exploration of sound and hearing. The novelty of this approach lies in its integration of science and mathematics to promote active, situated learning and in its use of computer-generated manipulatives to foster the development of physical intuition as a precursor to mathematical abstraction. Computer-generated sound waves are audible and are displayed both graphically and as an equation. Changing the sound or the graph or the equation produces appropriate changes in the other representations. Operations are performed on the waves in various "rooms," so that waves can be manipulated, added, multiplied, etc., and trigonometry, vector addition, logarithmic behavior, and Fourier series can be studied. The materials are field tested in area high schools and used in pre-service and in-service teacher education projects under a subcontract with the University of California, Irvine.

Descriptors: Computer Software, Fourier Series, Hearing, High School, In-Service Training, Integration of Science and Mathematics, Mathematics, One-Semester Curriculum, Sound, Trigonometry

Kenneth Suslick
Steven Zumdahl (Co-PI)
University of Illinois, Urbana
152 Computer Applications Building
605 East Springfield Avenue
Champaign, IL 61820
(217) 333-2794

9154132
$262,661
Start: 4/1/92
(24 months)

Visualization in Teaching Chemistry: Exploring Concepts via Interactive Visualizations

The National Center for Supercomputing Applications (NCSA), working with a national group of high school chemistry teachers, develops two modules—one on chemical bonding and the other on solvation—based on interactive scientific visualizations and animations under student control. The students use microcomputers in the classroom for visualization and use a phone modem to access simulation software developed at NCSA, under separate funding, for research projects. The goal of the project is to enhance the chemistry curriculum by enabling students to manipulate visual representations of abstract concepts and explore those concepts, thereby bringing the studying of chemistry closer to the doing of chemistry. The modules allow educators to explore and evaluate new pedagogical approaches to teaching and learning chemistry at the precollege level, taking advantage of both the dynamical, three-dimensional nature of the subject and of advances in technology.

Descriptors: Animation, Chemistry, Computer Simulations, Computer Software, High School, Interactive, Modules, Science, Supplemental, Telecommunications, Visualization

William J. Gerace
Jose Mestra, William H. Leonard, Robert DuFresne (Co-PIs)
University of Massachusetts, Amherst
Department of Physics
Amherst, MA 01003
(413) 545-3774

9255713
$883,435
Start: 3/1/93
(36 months)

Minds-On Physics: An Integrated Curriculum for Promoting Concept-Based Problem Solving in Physics

A year-long physics curriculum for high school students is designed to develop and integrate conceptual knowledge within problem-solving contexts. Students interact with other students and teachers in using concepts to analyze and solve goal-free, open-ended problems; in exploring the meaning of concepts through inquiry and hands-on activities; and in organizing their conceptual knowledge in ways that highlight the major ideas in physics. The curriculum is action-oriented, is consistent with constructivist epistemology, and illustrates the power of applying concepts other than formulaic approaches to solving problems. The modules cover the standard topics in high school physics courses and can be used as supplements to other approaches or as a stand-alone curriculum. The materials consist of a terse student reader, modeling activities, hands-on/inquiry activities, and a teacher's manual that contains the above plus information on preconceptions and suggestions for using other materials. This project is based both on a successful pilot project, which evaluated the approach in four ethnically diverse high schools, and on cognitive research on learning and problem solving.

Descriptors: Book, Conceptual Learning, Constructivist Approach, Hands-on Activities, High School, Inquiry, Modules, One-Year Curriculum, Open-Ended Problems, Physics, Problem Solving, Supplemental, Teacher Materials

John J. Clement
University of Massachusetts, Amherst
Scientific Reasoning and Research Institute
Hasbrouck Laboratory
Amherst, MA 01003
(413) 545-5864

9150002
$544,493
Start: 5/1/91
(36 months)

Methods for Improving Teaching Strategies in Science

Recent research has indicated that it is surprisingly difficult for students to achieve conceptual understanding in many fundamental topics in science. The primary focus of this project is learning studies aimed at fostering conceptual understanding. In such studies, individuals or pairs of students are taken through a lesson sequence and encouraged to think aloud during the sequence. A specific goal of the project is to develop exemplary lessons that can foster conceptual change in difficult areas. A more general goal is to identify critical learning processes and teaching strategies in successful science lessons that can guide curriculum developers and teacher trainers in other science areas. On the basis of preliminary studies, the project proposes to develop a set of learning-study methodologies that use a combination of descriptive and experimental methods. In addition to determining whether students do in fact learn from the lessons, the studies focus on identifying which teaching strategies are critical and why students learn from them. Major outcomes of the project include

(1) a set of exemplary science lessons for promoting conceptual change; (2) new methodologies for conducting learning studies in educational research; (3) descriptions of critical learning processes; and (4) descriptions of general teaching strategies for use in science lessons in other areas.

Descriptors: Conceptual Learning, Critical Thinking, Experimental Methods, High School, Physics, Research, Science, Supplemental, Teaching Strategies

Robert G. Fuller
Dean A. Zollman (Co-PI)
University of Nebraska, Lincoln
Department of Physics and Astronomy
14th and R Streets
Lincoln, NE 68588-0109
(402) 472-2790

9054659
$1,753,505
Start: 7/1/91
(48 months)

Every Physics Teacher's CD-ROM Toolkit

A CD-ROM is produced with materials that give all physics teachers access to a large collection of professionally useful information. The materials include tricks-of-the-trade, demonstration examples, laboratory experiment suggestions, scientific equipment catalogs, textbook publishers, physics lesson plans, reprints of articles on teaching, and articles about significant concepts. The sources of material for this CD-ROM include Physics Teacher Resource Agents, physics journals, earlier commissions on college physics, out-of-print classics, and commercial supply houses. The materials are being screened by a panel of teachers, and the resulting CD-ROM is evaluated by teachers of varying abilities. A software package is developed so that the information can be retrieved by both expert and novice teachers, as well as by students. Extensive workshops acquaint teachers with the use of the toolkit.

Descriptors: Articles, CD ROM, Computer Software, Demonstrations, High School, Kits, Lesson Plans, Physics, Resource Materials, Teacher Materials

Manuel P. Berriozabal
University of Texas, San Antonio
San Antonio Prefreshman Engineering Program
San Antonio, TX 78285-0661
(512) 691-5524

9150098
$294,569
Start: 7/15/91
(18 months)

Texas Prefreshman Engineering Program Writing Project

This project develops and distributes a complete kit for starting and conducting an intervention program for high school students, particularly minorities and women, considering a career in science and mathematics. This kit, based on the San Antonio Prefreshman Engineering Program (PREP), consists of curriculum materials and operational materials.

The textual materials include modules in Logic and its Application to Mathematics, Problem Solving, Introduction to Engineering, Computer Science, Algebraic Structures, Introduction to Physics, Introduction to Technical Writing, and Introduction to Probability and Statistics—all of which are academic components in the first, second, or third year of PREP and were developed by the PREP writing teams. These teams consist of college and high school teachers, as well as some students who have gone through the PREP program.

The operational materials include program brochures, sample application forms, follow-up survey forms, and statistical table forms. Copies of these materials are made available at cost to those organizations interested in starting such an intervention program.

Descriptors: Careers, Engineering, High School, Intervention, Kits, Mathematics, Minorities, Modules, Physics, Problem Solving, Science, Statistics, Women, Writing

Merrill K. Ridd
EDU-TEC
P.O. Box 58066
Salt Lake City, UT 84158-0066
(801) 584-4457

9350523
$100,000
Start: 8/1/93
(18 months)

Enriching American Science Education and Global Understanding Through New Technologies

A growing worldwide supply of environmental data, the availability of sophisticated and inexpensive computer-based hardware, and the development of user-friendly, flexible software makes possible the development of modules which can put students in touch with the world at any scale from the locality of the student to the world at large. Many national and international organizations are networked and committed to collecting and sharing increasing volumes of Earth-environmental data. There is a growing awareness of global change and environmental stress and the responsibility humans have for these conditions and their amelioration. Students can and should be part of the quest to explore these questions in new ways. Through hands-on image analysis and Geographic Information Systems (GIS) digital map manipulation, secondary school students can overlay remote-sensed data to see vital relations at the interface between humans and the natural world. Two modules, of 2 weeks duration, are developed in this pilot project: one is global in perspective such as decertification or tropical deforestation; the other concerns local conditions such as water use. The modules are developed by teachers, science educators, and scientists working together and are field tested in diverse locations. The software runs on a 386-equivalent computer that has enough memory to accommodate ArcView files and that has 4 megabytes of RAM. The project is governed by a national advisory board and has two external evaluators to document the effects on students and teachers.

Descriptors: Computer Software, Data Collection, Environment, Geography, Global Change, Hands-On Activities, High School, Modules, Remote Sensing

Raymond Kes[illegible]
James Stuart, Louise Elbaum (Co-PIs)
University of Wisconsin, Madison
Department of Medical Genetics
750 University Avenue
Madison, Wisconsin 53706
(608) 262-1234

9252950
$542,049
Start: 4/1/92
(36 months)

Development of Elementary, Middle, and Secondary School Instructional Materials in Genetics and Biotechnology

This project develops and revises instructional materials for K–12 based on genetics activities that have been developed by classroom teachers. These 60 genetics activities (20 elementary, 20 middle school, and 20 high school) can also be integrated into existing science texts. They address genetics in several contexts. Some integrate genetics content with arts or language curricula. Others address issues of genetics in social and personal contexts. In addition to the development of genetics modules, workshops illustrating project use are held at national professional conferences to share these and other activities with teachers at the precollege level.

Descriptors: Biology, Biotechnology, Book, Content Integration, Curriculum, Elementary School, Ethics, Genetics, High School, Inquiry, Life Sciences, Middle School, Modules, Societal Issues, Supplemental, Teacher Enhancement, Workshop

John W. Moore
John Lagowsky (Co-PI)
University of Wisconsin, Madison
Department of Chemistry
750 University Way
Madison, WI 53706
(608) 262-5154

9154099
$1,304,222
Start 3/1/92
(36 months)

The Images of Chemistry

A series of video images is produced; the series can be used in a variety of formats to enhance student-teacher and student–subject-matter interactions in chemistry education. The video, which extends the range of video images shown on the Periodic Table Videodisc produced by the same developers, shows primarily chemicals, their reactions, and their practical applications. These videodisks allow a great deal of descriptive chemistry to be introduced in an interesting way into beginning courses. In addition, some hard-to-visualize theoretical constructs of chemistry are included. Historically, important people, artifacts, experiments, and documents are shown including the contributions of those from groups underrepresented in chemistry.

The completed images are distributed, on videodisk, through *Journal of Chemical Education: Software* and are also available for future publication in other formats. Example lessons based on the published videodisks in both computer-interactive and stand-alone modes are provided. The materials are suitable for use in grades 8–12 and also in introductory courses in 2- and 4-year colleges.

Descriptors: Applications, Chemistry, Demonstrations, High School, History of Science, Interactive, Middle School, Postsecondary, Science, Student Activities, Supplemental, Text, Videodisk

D. Joseph Clark
Videodiscovery
1700 Westlake Avenue North
Seattle, WA 98109
(206) 285-5400

9353033
$1,228,985
Start 4/15/94
(18 months)

Genetics Today: Understanding the Human Genome

The Human Genome Project has brought to the public view the importance and excitement of genetics in our society. This videodisk project focuses on that project and especially bioethics to motivate the study of the fundamentals of molecular and cell biology and genetics. The 9-week curriculum is issues-oriented because increasingly individuals will be faced with making family, career, and medical decisions based upon this knowledge. The modules are entitled "Fundamental Concepts," "The Human Genome," "Developmental Genetics," "Human Genetics," "Population," and "Evolutionary Genetics." Themes are developed in each area relative to the human organism, with focus on modern molecular mechanisms of inheritance, DNA, RNA, genes and their variable expression, congenital defects, the human genome, and bioethical considerations of genetic technologies. Critical thinking and problem-solving abilities are emphasized to create a body of students who will continue to understand the issues related to genetics. The videodisk-based materials are coordinated with biology courses developed under National Science Foundation funding. Appropriate role models from groups under-represented in science, as well as career information, will be provided. In addition to the videodisks, the materials include a textual encyclopedia of modern genetics, computer software to control and search the disk and the encyclopedia, and lesson plans. The materials are pilot tested in diverse locations. Teacher workshops and an on-line bulletin board are available.

Descriptors: Biology, Careers, Cell Biology, Computer Software, Critical Thinking, Ethics, Genetics, High School, Human Genome, Molecular Biology, Problem Solving, Societal Issues, Teacher Materials, Videodisk

Mary Paden
World Resources Institute
Department of Publications
1709 New York Avenue, NW
Washington, DC 20006
(202) 638-6300

9255807
$224,482
Start 7/1/93
(24 months)

World Resources Datascope

This project proposes to create an interactive computer program and database titled *Datascope* that is a storehouse of environmental information. The most comprehensive data now available on natural-resource and environmental issues in 146 countries of the world are used as a source of information for this program. Students are able to manipulate this database, add their own data, and seek solutions to environmental problems with the aid of developed support materials and an education software program. The project is well designed and would make a valuable environmental database available in an interactive format that students could use in solving real problems. Students, using these materials, would gain experience in data manipulation, mapping, analysis, data use and understanding. Portions of the program could be used in the social sciences equally well. The World Resources Institute, the Technical Education Research Center, and the Canadian Space Agency work collaboratively to develop a student and teacher guide for data analysis and interpretation.

Descriptors: CD-ROM, Computers, Computer Software, Data Analysis, Databases, Ecology, Environment, Environmental Science, Geography, High School, Middle School, Problem Solving, Real-World Problems, Social Sciences, Supplemental, Teacher Materials

High School Mathematics

Gail Burrill
Barbara Bailar (Co-PI)
American Statistical Association
1429 Duke Street
Alexandria, VA 22314-3402
(703) 684-1221

9054648
$1,100,000
Start 1/1/91
(36 months)

A Data-Driven Curriculum Strand for High School Mathematics

This 3-year project is a natural extension of the highly acclaimed Quantitative Literacy Project. It produces a set of 10–12 modules that integrate statistical concepts into the algebra, geometry, trigonometry, and functions strands of a revitalized grades 9–12 curriculum. The expanded coverage of statistical topics is tied to a detailed scope and sequence plan to facilitate implementation in conventional course structures.

Within each module, the students' understanding of mathematical concepts evolves through the process of posing questions, collecting relevant data, analyzing the data, and discussing the results. Modules foster problem solving, cooperative learning, communication, project work, and reflect the use of both computer and graphing calculator technologies. The development and application of alternate pupil assessment methods form an integral part of the project materials. A teacher support manual and a series of leadership workshops for purposes of dissemination are also being produced.

Descriptors: Calculators, Computers, Data Analysis, Data Collection, High School, Inquiry, Mathematics, Modules, Multiyear Curriculum, Problem Solving, Statistics

L. Michael Perry
Gary D. Kader (Co-PI)
Appalachian State University
Department of Mathematical Sciences
Boone, NC 28606
(704) 262-3050

9150117
$320,842
Start 7/15/91
(36 months)

STAT-MAPS

STAT-MAPS, a 3-year project, prepares instructional materials for the teaching of statistics in grades 9–12. The project is informed by the Quantitative Literacy Project and statistical education work in the United Kingdom. It builds on the developer's SIM-PAC project, which developed classroom materials and software for teaching probability concepts through simulation model building.

The project materials are field tested by teachers who have been enhanced through the NSF Teacher Enhancement project, STAT-LINK, which is preparing 24 resource teachers from throughout North Carolina to provide leadership in an evolving statistics curriculum in the state. The project is producing a student text, a teacher's manual, and an activities manual to support a statistics curriculum rooted in experiential learning through engagement in exploratory and experimental statistical problem solving.

The role of data is preeminent – data collection, design, and measurement ideas are to be present in every problem. Provisions are being made for cycles of extensive testing, review, and revision of the materials. Project evaluation will include systematic monitoring and recordkeeping of classroom teaching processes involving use of the materials, cognitive assessment of students' statistical thinking, and assessment of student and teacher attitudes.

Descriptors: Assessment, Computers, Data Analysis, Data Collection, High School, Mathematics, Problem Solving, Statistics, Student Activities, Teacher Materials, Text

Robert Devaney
Boston University
Department of Mathematics
Boston, MA 02213
(617) 353-4560

9255724
$628,688
Start 3/1/93
(22 months)

Chaos and Fractal Teaching

The purpose of this project is to develop teaching materials that will allow high school teachers to introduce various concepts from dynamical systems theory and fractal geometry into the high school curriculum. The project will include the development of approximately 15 modules, each dealing with a single topic from fractal geometry or dynamical systems. Some modules will be able to be used independently; some will be developed to be used in a sequence of successive class sessions. Each module will contain background materials, preliminary student worksheets, a short video, and suggested follow-up activities. Specific materials to be developed include videotapes, software, Hypercard stacks, worksheets, and teacher guides. The aim is to help teachers show students the vitality of modern mathematics with material that complements and enhances the standard high school curriculum. Also planned is a 2-week summer institute to train teachers to bring these ideas from modern mathematics into their classrooms.

Descriptors: Computers, Computer Software, Dynamical System Theory, Fractal Geometry, High School, Mathematics, Modules, Student Activities, Supplemental, Teacher Materials, Videotape

Tom M. Apostol
California Institute of Technology
Department of Mathematics
1201 East California Boulevard
Pasadena, CA 91125
(818) 356-3759

9150082
$2,033,538
Start: 5/15/91
(36 months)

Project Mathematics!

This project produces professional-quality videotapes on mathematical topics for high school students. The tapes use computer-generated animation and are structured so that there will be interaction between the tapes, the teacher, and the students. Interaction is accomplished by workbook references which contain student activities that accompany the tapes. The tapes are disseminated by a consortium of state organizations, as well as the National Council of Teachers of Mathematics and the Mathematical Association of America. Further distributions occur with the financial support of various foundations. All materials are made available on a nonprofit basis through the California Institute of Technology bookstore.

Descriptors: Animation, High School, Mathematics, Student Activities, Supplemental, Videotape

Tom M. Apostol
California Institute of Technology
1201 East California Boulevard
Pasadena, CA 91125
(818) 356-6811

9452762
$23,155
Start: 9/1/94
(4 months)

Project Mathematics! CD-ROM Research

This planning grant supports the determination of how best to produce interactive multimedia CD-ROM versions of existing and future modules of "Project Mathematics!," a series of professional broadcast quality computer-animated videotapes on various topics in basic mathematics at the secondary level. These topics range from geometry to trigonometry, algebra, and modeling. Information about multimedia playback hardware, software tools, design, production, and technical support is being gathered by examining existing production tools and software, attending seminars and conferences, interviewing and consulting knowledgeable colleagues and representatives of appropriate companies, and studying trade journals.

Descriptors: Algebra, Animation, CD-ROM, Geometry, High School, Modeling, Trigonometry

June Ellis
The Hartford Alliance for Mathematics and Science Education
CBIA Education Foundation
370 Asylum Street
Hartford, CT 06102-2022
(203) 547-1661

9255251
$3,736,315
Start: 9/1/92
(48 months)

The Secondary Mathematics Core Curriculum Initiative

This project develops a 3-year high school mathematics curriculum, a transition course for college-bound students for the 4th year, and two additional courses for the 4th year for students not planning to attend college. In-service enhancement of teachers is an important component of this project. Training videos are included. Materials are developed by the Hartford Alliance for Mathematics and Science Education, a coalition of businesses, educators, universities, public schools, parents, and concerned citizens who earlier created a 9th grade curriculum, which forms the basis of this effort.

Descriptors: High School, In-Service Training, Mathematics, Multiyear Curriculum, Teacher Enhancement, Videotape

Solomon A. Garfunkel
Consortium for Mathematics and Its Applications (COMAP)
Department of Mathematics
60 Lowell Street
Arlington, MA 02174
(617) 437-5640

9255252
$4,610,110
Start: 8/1/92
(60 months)

Applications/Reform in Secondary Education (ARISE)

This 5-year project develops a 3-year secondary school mathematics curriculum. This curriculum consists of a 9–11 core which is application- and modeling-based. Many of the models are based on COMAP's extensive collection of application modules. The materials—which incorporate computer and calculator experiences, a video applications library, appropriate assessment instruments, and teacher manuals—are developed by the project staff and a 30-member writing team including many high school teachers. The Educational Film Center also assists with video development. Rutgers University and the University of Wisconsin, Madison, direct the field testing. The Freudenthal Institute of the Netherlands assists in the development of appropriate assessment strategies.

Descriptors: Algebra, Applications, Assessment, Calculators, Comprehensive, Computers, Curriculum Framework, Geometry, High School, Integrated Curricula, Mathematics, Multiyear Curriculum, Teacher Materials, Text, Videotape

Solomon A. Garfunkel
Consortium for Mathematics and Its Applications (COMAP)
Department of Mathematics
60 Lowell Street
Arlington, MA 02174
(617) 437-5640

9154090
$1,562,464
Start: 1/1/92
(48 months)

Geometry and Its Applications (GEOMAP)

This project develops 20 modules from which alternative curricula are constructed. The program initiates an attempt at a major reform in the content and methodology of teaching geometry in American high schools. The intent is to give students a richer understanding of geometric facts and methodologies, mathematical concepts at the heart of geometry, visual thinking, and the relevance of geometry to daily life. Final products are disseminated nationally through COMAP and a commercial publisher.

Descriptors: Geometry, High School, Mathematics, Modules, One Year Curriculum, Supplemental

Lawrence C. Moore, Jr
David A. Smith (Co-PI)
Duke University
Department of Mathematics
211A Physics Building
Durham, NC 27706
(919) 660-2822

915327_
$259,459
Start: 8/1/91
(24 months)

Dissemination of Project CALC Methods and Materials

Third-semester calculus materials are completed for teaching three semesters of calculus as a laboratory course in college. The current work includes the expansion of the repertoire of classroom and laboratory projects, development of versions of alternate software and

hardware environments, and completion of a high school version of the course. The methods and materials for all three semesters are evaluated and widely disseminated by workshops for college-level and precollege-level faculty, by continued publication of a newsletter, and by production of preliminary materials.

Descriptors: Calculus, Computers, Computer Hardware, Computer Software, High School, Mathematics

Albert A. Cuoco
Education Development Center (EDC), Inc.
55 Chapel Street
Newton, MA 02101
(619) 965-6325

9252952
$2,150,186
Start: 8/1/92
(48 months)

Priming the Pump: Connected Geometry

This project develops a set of curriculum materials and accompanying teacher-support materials that use geometry to bring a culture of mathematical exploration into the classroom and to interconnect students' experiences with various parts of mathematics. The materials, which rely heavily on existing geometry software and hands-on activities, include (1) a library of student activities designed so they can be used to form coherent units addressing specific content and themes; (2) a Curriculum Map Maker designed to help teachers select activities and sequences of related activities, ranging from extensions of existing geometry courses to completely new courses; and (3) a Self-Guided In-Service Package to help teachers learn to make effective use of the toolkit and to explore the new models of teaching embodied in the activities. The activities are designed to foster students' development of mathematical ways of reasoning, analyzing, and communicating; to link geometry to science, technology, art, and other areas of students' experience; and to link geometry to important ideas in other areas of mathematics including algebra, analysis, number theory, and linear algebra.

Descriptors: Computer Simulations, Computer Software, Geometry, Hands-On Activities, High School, In Service Training, Kits, Mathematics, One-Year Curriculum, Problem Solving, Student Activities, Supplemental, Teacher Materials

Thomas DeRose
Envision Interactive
504 Briar Road
Bellingham, WA 98225
(206) 676-7145

9450228
$500,000
Start: 8/15/94
(27 months)

High School Mathematics Courseware: Utilizing Real-World Problem-Solving to Teach Mathematics

The preparation that students receive in kindergarten through grade 12 and college is no longer adequate to sustain our nation's superiority in mathematics, science, and technology. A major educational reform is essential. The National Council of Teachers of Mathematics (NCTM) Curriculum and Evaluation Standards provide excellent direction for changes in mathematics education and have inspired the development of this real-world problem-solving high school mathematics courseware. With this courseware, teachers can base their instruction on real-world problems to be solved using mathematics and provide their students with the power of computing technology to do so. The courseware consists of (1) a set of 60 simulated real-world problems that require practical solutions; (2) a set of 15 mathematical, measurement, and data-collection computing utilities; and (3) a teacher guide. Students are invited to explore problems, implement problem-solving strategies, apply the appropriate mathematical concepts, select and apply the computer utilities they think are appropriate, and determine whether or not the problems have been adequately solved. This courseware is available in CD-ROM–based multimedia, as well as videotape and stand-alone computer software.

Descriptors: CD-ROM, Computer Software, Courseware, Elementary School, High School, Mathematics, Middle School, NCTM Standards, Real-World Problems, Teacher Materials, Videotape

Maurice Bazin
Exploratorium
3601 Lyon Street
San Francisco, CA 94123
(415) 563-7337

9450279
$387,940
Start: 9/1/94
(17 months)

The Multicultural Science and Mathematics Snackbook

The Exploratorium Teachers Institute proposes to develop, test, and distribute three multicultural science and mathematics monographs for use in middle and high school classrooms. After extensive classroom testing, the three monographs will be revised and combined into one book for national dissemination. These publications will (1) present science and mathematics through tools and designs from a variety of world cultures and (2) provide related hands-on, investigatory activities for students. The philosophy and format of the publications will be based on the successful *Exploratorium Science Snackbook*. The initial publications will be self-published and distributed. A revised product, based upon feedback from initial users, will be published commercially. The proposed publications are designed to increase awareness of multicultural issues for all students, while making science more relevant and approachable to minority students.

Descriptors: Book, Hands-On Activities, High School, Mathematics, Middle School, Minorities, Multicultural, Science, Student Activities

Steven Heard
Shelley Beckman, Rob Mikuriya (Co-PIs)
Foundation for Advancements
in Science and Education
1801 Wilshire Boulevard, Suite 215
Los Angeles, CA 90010
(213) 937-9911

9054655
$990,517
Start: 5/1/91
(30 months)

"Futures with Jaime Escalante": Motivational Mathematics Video Series Grades 7–12

This project develops videotape materials to enhance student interest in mathematics. These videos show students the world of opportunity open to those with good mathematical skills. In particular, the videos involve women and minorities, thus providing role models for women and minority students. Each video involves Jaime Escalante and people who have successfully applied mathematical skills in their chosen profession or job. The materials include teacher materials for each video. Teacher materials provide supplementary information for the teacher to use in leading discussions concerning the mathematics involved.

Descriptors: Careers, Female, Group Discussion, High School, Mathematics, Middle School, Minorities, Supplemental, Teacher Materials, Videotape

---

Jerald Murdock
Interlochen Arts Academy Mathematics
Interlochen, MI 49643
(616) 276-9221

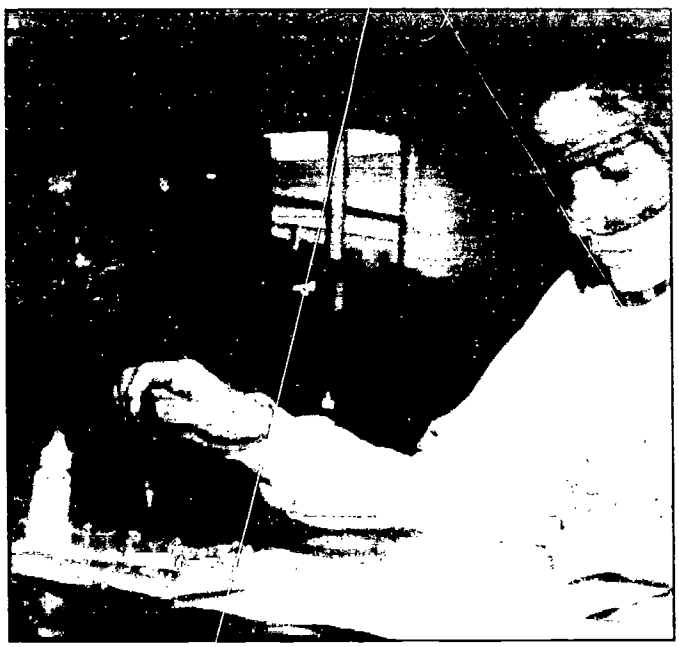
9154410
$93,767
Start: 6/1/92
(24 months)

Graphing-Calculator–Enhanced Algebra Project

This project develops instructional materials for incorporating the use of graphing calculators in algebra. The lessons and "investigations" using graphing calculators are designed for direct use by the students and include materials for the teachers to aid them in the use of materials. Transitional materials that help the student make the leap from simple calculators to graphing calculators and that provide an early introduction to experimentation in mathematics are developed. The project personnel provides in-service workshops for teachers, both during the year and in the summer. These materials are published in a monograph by the Michigan Council of Teachers.

Descriptors: Calculators, High School, In-Service Training, Mathematics, Middle School

---



Donald Esterling
Microcompatibles, Inc
301 Prelude Drive
Silver Spring, MD 20901
(301) 593-5151

9255715
$547,600
Start: 5/1/93
(36 months)

Manufacturing Technology Learning Modules: Integrating Mathematics and Technology Education Curriculum

This project develops materials that are used with existing computer-assisted design software, developed by Microcompatibles under a National Science Foundation Small Business Innovation Research grant. The software creates a block on the screen; the block can be cut and drilled to make a part by using easy-to-learn commands. The student sees the part being cut on the screen and can zoom in and measure different areas of the part. Once the instructions for cutting have been completed, they can be sent by network or modem to a shop in which the part is actually made and sent to the student. This helps students learn three-dimensional visualization and integrate technology and math curricula. The materials are designed to motivate the study of mathematics in a technological context.

Descriptors: Applications, Computer-Assisted Design, Computer Software, High School, Mathematics, Real-World Problems, Technology Education, Three-Dimensional Visualization

---

Jo Ann Lutz
North Carolina School of Science and Mathematics
P.O. Box 2418
West Club Boulevard and Broad Street
Durham, NC 27705
(919) 286-3366

9252901
$634,393
Start: 8/1/92
(36 months)

Contemporary Calculus for the High School Classroom

This 3-year project develops materials for an applications-oriented calculus course designed for the high school classroom. Materials include (1) a complete text for a two-semester, single-variable calculus course, (2) a laboratory manual for full component of computer laboratory experiments, and (3) an alternative complement of laboratory experiments for graphing calculators.

Descriptors: Applications, Calculators, Calculus, Computers, Computer Software, High School, Mathematics, One Year Curriculum, Postsecondary, Text

---

R PH Chang
Northwestern University
633 Clark Street
Evanston, IL 60208
(312) 491-3741

9353833
$1,797,779
Start: 5/1/94
(22 months)

Materials World Modules

The "Materials World Modules" constitute a series of materials science and technology kits designed to supplement existing mathemat-

ics and science curricula in high schools. The modules close the gap between frontiers of research and science in classrooms, providing open-ended experiences for both students and teachers. Nine modules cover basic materials systems, materials and society, and materials conservation and the environment. The modules provide students with hands-on experiences in design, synthesis, and evaluation of materials. The concepts of mathematics and science are reinforced in the application of materials science and technology to product development and manufacturing. Each module includes a self-contained experimental kit, teacher and student manuals, a videotape showing how experiments are conducted—including safety instructions—and a software package for data analysis and further modeling of the experiment. The products are developed by professors in the Materials Research Center at Northwestern working with educators and high school science, mathematics, and technology teachers. A central electronic databank on materials will be maintained at the Materials Research Center.

Descriptors: Applications, Book, Chemistry, Computer Software, Databases, Hands-On Activities, High School, Kits, Laboratory, Materials Science, Mathematics, Modules, Physics, Science, Teacher Materials, Technology Education, Videotape

Diane Kesek
Lynne K. Alper, Sherry Fraser, Daniel Fendel (Co-PIs)
San Francisco State University Foundation, Inc
Department of Mathematics
San Francisco, CA 94132
(510) 658-6400

9255262
$9,059,941
Start: 9/1/92
(42 months)

Interactive Mathematics Project

This project builds on Phase I of the Interactive Mathematics Project. In Phase I, a new 3-year high school mathematics curriculum that embodies the National Council of Teachers of Mathematics Standards was developed, pilot tested, and field tested for 2 years with diverse populations. This new secondary mathematics curriculum eliminates tracking completely and has proven to be effective with all students at all levels. Phase II builds on the work of Phase I by developing a 4th year curriculum; reexamining and then revising all 3 years with the goal of improving continuity; writing supplementary materials to allow greater teacher flexibility in meeting the wide range of student needs; conducting a thorough evaluation of the effectiveness of the curriculum; assessing the various models of teacher inservice; and disseminating the program widely through large regional centers.

Descriptors: High School, NCTM Standards

Keith Finkral
R. Todd, T. Hughes (Co-PIs)
Trenton State College
School of Technology
3 Armstrong Hall
Trenton, NJ 08650-4700
(609) 530-7600

9450249
$766,368
Start: 10/1/94
(48 months)

Professional LINKS Project

Instructional materials that integrate mathematics, science, and technology education are greatly needed. This project produces several instructional packages for secondary school students; the packages are consistent with the standards from each of the disciplines. The units are published as supplements in journals, such as *TIES Magazine*, *The Technology Teacher*, *The Mathematics Teacher*, and *The Science Teacher*, to reduce the lead time from development to use. They are developed in a collaborative effort among teachers, subject specialists, and practitioners from science and industry. Local and national support is available to help teachers and groups of teachers use the materials. The research and evaluation component measures the impact of the units and provides models for increased use. The products include the units, teacher guides for use of the materials, and support via electronic means. Themes to be engaged include science and technology of sports, biotechnology, music, and fire-prevention and control systems.

Descriptors: Elementary School, Hands-On Activities, High School, Mathematics, Middle School, Multidisciplinary, NCTM Standards, Science, Student Activities, Teacher Materials, Technology Education

Mark B. Dolson
University of California, San Diego
CRL-0126
9500 Gilman Drive
La Jolla, CA 92093
(619) 534-2678

9054644
$366,534
Start: 1/1/91
(24 months)

Learning Mathematics and Science Through the Exploration of Sound

Computer-based materials are created to enable high school students to develop specific concepts in advanced mathematics and trigonometry through guided exploration of sound and hearing. The novelty of this approach lies in its integration of science and mathematics to promote active, situated learning and in its use of computer-generated manipulatives to foster the development of physical intuition as a precursor to mathematical abstraction. Computer-generated sound waves are audible and are displayed both graphically and as an equation. Changing the sound or the graph or the equation produces appropriate changes in the other representations. Operations are performed on the waves in various "rooms," so that waves can be manipulated, added, multiplied, etc., and trigonometry, vector addition, logarithmic behavior, and Fourier series can be studied. The materials are field tested in area high schools and used in pre-service and in-service teacher education projects under a subcontract with the University of California, Irvine.

Descriptors: Computer Software, Fourier Series, Hearing, High School, In-Service Training, Integration of Science and Mathematics, Mathematics, One-Semester Curriculum, Sound, Trigonometry

James F. Hurley
University of Connecticut
Storrs, CT 06269
(203) 486-2000

9252463
$177,746
Start: 9/1/92
(30 months)

Implementing Computer-Integrated Calculus in High Schools

The project is adapting the University of Connecticut's computer-integrated calculus program to high school calculus courses under the university's High School Cooperative Calculus Program. University of Connecticut faculty and graduate students and teachers from 13 Connecticut high schools will work together to rewrite materials, present these materials at summer workshops, and coordinate pilot testing of the materials. Revisions based on the pilot testing will be made, and full-scale field testing implemented. Student performance in high school as well as subsequent performance at the university will be carefully tracked.

Descriptors: Calculus, High School, Materials Revision, Mathematics

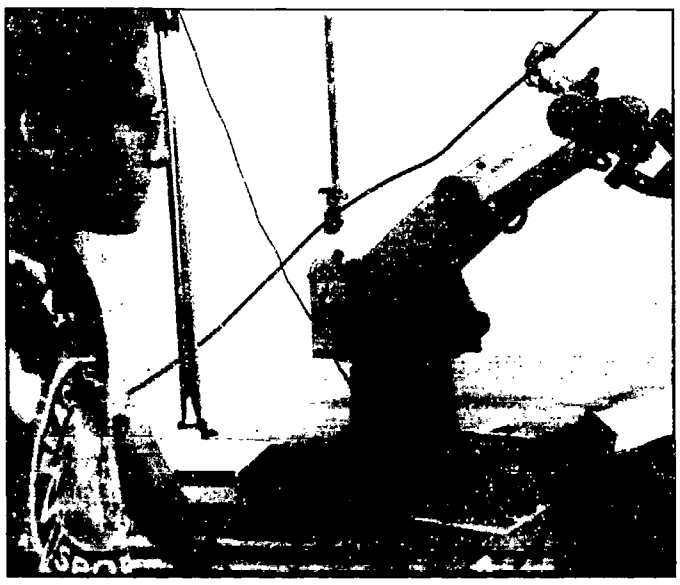
W. Gary Martin
University of Hawaii, Manoa
College of Education
1776 University Avenue
Honolulu, HI 96822
(808) 956-4985

9150027
$1,100,000
Start: 7/1/91
(24 months)

The Effects of Problem-Based Instruction on the Geometric Knowledge of High School Students

The Curriculum and Evaluation Standards for School Mathematics of the National Council of Teachers of Mathematics calls for a shift in paradigm in the teaching of school mathematics from skills-based instruction to problem-based instruction. This research project studies the effects of problem-based instruction on the concepts and thought processes of high school geometry students.

Over the course of this 3-year project, a teaching model that focuses on student solving of problems and that is accessible to students of various abilities is designed. The effects of this instruction are assessed from two contrasting yet interactive perspectives: the use of problem-solving processes and knowledge of particular geometric concepts. The geometric problem-solving processes being investigated include the abilities to (1) generalize from empirical evidence, (2) generalize using deductive evidence, (3) deal with reverse trains of thought, (4) flexibly refocus a train of thought, and (5) visualize a geometric situation. The geometric concepts to be investigated include the concepts of (1) proof; (2) infinity; (3) similarity and congruence; (4) area, perimeter, and volume; (5) parallelism; and (6) transformations.



Data collection is threefold: (1) teaching experiments with individual students to assess particular instructional approaches, (2) teaching experiments with intact classes to assess the changing nature of instruction and classroom interactions, and (3) status testing to document developing concepts and processes.

Descriptors: Assessment, Data Collection, Geometry, High School, Mathematics, NCTM Standards, Problem Solving

John T. Baldwin
Roberta L. Dees (Co-PI)
University of Illinois, Chicago
P.O. Box 6998
Chicago, IL 60607
(312) 996-3041

9253326
$700,000
Start: 4/1/93
(36 months)

College Preparatory Mathematics Project

This project continues enhancing teachers at the University of Illinois, Chicago, and begins the enhancement of teachers at two other sites—the University of Wisconsin, Parkside, and DePaul University. Enhancement consists of intensive summer workshops on student-centered methods for teaching, such as cooperative learning, a technique that uses innovative problem-solving and applications-oriented materials. The teachers gain experience using the materials in the summer by teaching groups of high school students taking summer courses. Each teacher implements the materials in a double-period class of first-year integrated high school mathematics during the following school year for the same students that attended the summer course. There are support seminars during this school year to support the teachers, as well as in-class observation by project staff. This support continues for two more summers and school years, with the teachers teaching second- and third-year high school mathematics those years to the same students. In a total of five high schools spread among the three centers, the Interactive Mathematics Project materials are implemented by the teachers supported by this project. A comprehensive evaluation plan tracks student performance and retention of teachers from this project.

Descriptors: Applications, Cooperative Learning, High School, Implementation, Mathematics, Problem Solving, Teacher Enhancement

Albert Marden
University of Minnesota, Twin Cities
1100 Washington Avenue
South Minneapolis, MN 55415
(612) 625-5000

9350485
$99,995
Start: 8/1/93
(12 months)

Geometry Center Materials Development

This project plans for the development of a unified environment where research mathematicians, scholars in mathematics education,

high school and college teachers, skilled programmers, and material developers can interact to develop materials for mathematics education at all levels. The central focus would be geometric visualization. High priority in the major project would be on the development of materials that are easy to use for both teacher and student upon dissemination. The materials to be developed would include computer programs, narrated videos, text materials, and manipulatives. The planning process would include the establishment of contacts and ties with various producers of visualization materials, commercial publishers, nationwide curricul · · projects, and experts in dissemination and testing, as well as mathematics education specialists and high school and college teachers.

Descriptors: Book, Computers, Computer Software, Mathematics, Planning Grant, Videotape, Visualization

Manuel P. Berriozabal
University of Texas, San Antonio
San Antonio Prefreshman Engineering Program
San Antonio, TX 78285-0661
(512) 691-5524

9150098
$294,569
Start: 7/15/91
(18 months)

Texas Prefreshman Engineering Program Writing Project

This project develops and distributes a complete kit for starting and conducting an intervention program for high school students, particularly minorities and women, considering a career in science and mathematics. This kit, based on the San Antonio Prefreshman Engineering Program (PREP), consists of curriculum materials and operational materials.

The textual materials include modules in Logic and its Application to Mathematics, Problem Solving, Introduction to Engineering, Computer Science, Algebraic Structures, Introduction to Physics, Introduction to Technical Writing, and Introduction to Probability and Statistics—all of which are academic components in the first, second, or third year of PREP and were developed by the PREP writing teams. These teams consist of college and high school teachers, as well as some students who have gone through the PREP program.

The operational materials include program brochures, sample application forms, follow-up survey forms, and statistical table forms. Copies of these materials are made available at cost to those organizations interested in starting such an intervention program.

Descriptors: Careers, Engineering, High School, Intervention, Kits, Mathematics, Minorities, Modules, Physics, Problem Solving, Science, Statistics, Women, Writing

Jack M. Robertson
Washington State University
Business Grants Office
Pullman, WA 99164-3140
(509) 335-9661

9252986
$278,927
Start: 5/1/92
(12 months)

Agriculture-Based Secondary Mathematics Project

This project develops instructional materials that examine the role of mathematics in agriculture. The materials are designed to supplement existing secondary mathematics classes and include student work pages, computer exercises, cooperative learning projects, and a videotape informing students of the important role of mathematics in agriculture. The materials are based on information gathered from practicing agriculture professionals in eastern Washington, and the program is being piloted in six districts. Additional teachers are enhanced to use the materials during a 1-week conference and through courses taught at Washington State University.

Descriptors: Agriculture, Algebra, Geometry, High School, Mathematics, Multidisciplinary, Student Activities, Supplemental, Videotape

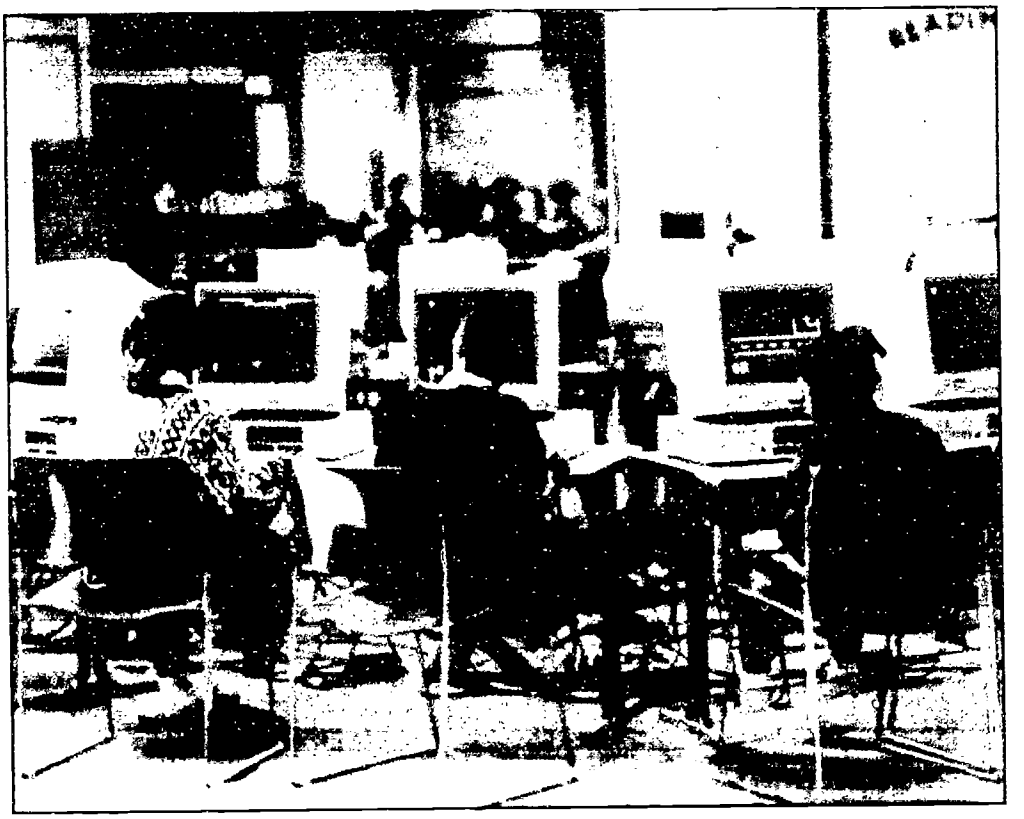
Christian R. Hirsch
Western Michigan University
Department of Mathematics
Kalamazoo, MI 49008
(616) 383-1600

9255257
$4,686,545
Start: 9/1/92
(60 months)

Core-Plus Mathematics Project

This project develops, field tests, evaluates, and disseminates a complete 3-year high school mathematics curriculum for all students. Each year, the curriculum features multiple strands of algebra/functions, geometry/trigonometry, statistics/probability, and discrete mathematics connected locally by common topics and globally by the fundamental themes of data, representation, shape, change, and chance. The curriculum emphasizes mathematical modeling and features full use of graphics calculators. The project produces a curriculum consisting of a common core of mathematical experiences for all students together with differentiated applications and extensions of core topics. Preliminary material for a 4th-year course is also under development. The project is a joint undertaking of development teams at the Ohio State University, the University of Iowa, the University of Maryland, the University of Michigan, and Western Michigan University.

Descriptors: Algebra, Calculators, Curriculum Framework, Discrete Mathematics, Geometry, High School, Integrated Curricula, Mathematics, Multiyear Curriculum, Problem Solving, Text



Assessment Projects

I. Dwaine Eubanks
Clemson University
Box 345702
300 Brackett Hall
Clemson, SC 29634-5702
(803) 656-3311

9255836
$423,919
Start: 8/15/93
(18 months)

Chemistry Computer-Based Objective Assessment Tasks (Com-BOAT)

Typically students are assessed in chemistry on their ability to provide answers to short questions. These tests do not measure the materials instructors feel students should learn, the level of student understanding of concepts, or student mastery of a particular concept. Only in the laboratory have assessments been made on the basis of integrated activities, but laboratories come under attack for other reasons. This project develops, validates, and tests eight computer-based scenarios, based on ChemCom, in which parameters can be carried to provide different outcomes. The scenarios assess student knowledge of chemistry content, level of student understanding, and ability to make science-based decisions on societal issues. Resources are available to students to address the chemical issues raised in the scenario. Help can be given electronically. The student outcome can be electronically scored in relation to the reasoning described and the help given. The assessments can be used to inform instruction and also to provide objective, bias-free measures useful in high-stakes testing. The computer-based objective assessment tasks (Com-BOATS) are designed by project personnel with experience in developing examinations at the American Chemical Society Examinations Institute using Authorware Pro shells. The tasks are pilot and field tested nationally in classrooms. The results are interpreted by third-party evaluators.

Descriptors: Assessment, ChemCom, Chemistry, High School, Societal Issues

Margaret Jorgensen
Educational Testing Service
Princeton, NJ 08540

9154422
$289,421
Start: 1/15/92
(36 months)

Authentic Assessment for Multiple Users

This project is an investigation of the ability of elementary and middle school science and mathematics teachers, students, parents, and evaluators to develop and reach consensus on portfolio assessments to produce aggregate data within individual schools and across others which exhibit diversity along key dimensions (such as size, location, and racial/ethnic makeup of student population). Formative and summative measures (ranging from low-inference to high-inference) are used to evaluate the proposed activities in terms of four targets: utility of the model, feasibility of the consensus-building process, meaning—for multiple users—of the data, and extent to which the project was implemented.

Descriptors: Assessing Student Learning, Elementary School, Mathematics, Middle School, Parents, Portfolio Assessment, Science

John R. Frederiksen
Educational Testing Service
Rosedale Road
Princeton, NJ 08540
(415) 596-5848 (California Field Office)

9154433
$1,037,598
Start: 1/15/92
(36 months)

Performance Assessment as a Tool for Enhancing Learning in Middle and Secondary School Science

This project develops a basis for constructing and scoring conceptually rich performance tasks to serve the goals of enhancing both the teaching and learning of science. Classroom-based experimental trials explore a set of alternative assessment models for middle and secondary school science. These trials are carried out in schools and incorporate a variety of assessment activities. In addition, alternative rubrics for scoring the activities are developed. The project examines not only the effectiveness of the different performance assessments and scoring rubrics for enhancing the students' learning but also their effectiveness in improving teaching.

Descriptors: High School, Mathematics, Middle School, Performance Assessment

Kathleen Kelly-Benjamin
Florida Institute of Technology
Science Education Department
150 West University Boulevard
Melbourne, FL 32901-6988
(407) 769-8000

9255790
$309,115
Start: 5/1/93
(24 months)

The T2M3 Project: Teachers Using Testing to Measure Mathematics Meaningfully

This project examines teachers' capabilities for creating and using meaningful assessment instruments in mathematics. This project brings together mathematics teachers, assessment experts, mathematicians, and educators in a collaborative effort to improve assessment in mathematics. Eight teams of elementary and middle school teachers, with prior experience in integrating technology into the math curriculum, receive extensive training in developing assessment procedures that emphasize higher order thinking processes. The teams learn how to develop dynamic assessment materials, create assessment materials that incorporate innovative instructional technology, and field test and evaluate the developed materials in their classrooms. Evidence of teachers' capabilities and accomplishments are being collected through interviews, observations, and analysis of field notes. Case studies are developed to characterize teachers' efforts.

Descriptors: Assessing Student Learning, Elementary School, Instructional Technology, Mathematics, Middle School, Thinking Processes

Rosemary Wray Williams
Lewis and Clark University
9840 Southwest Eagle Lane
Beaverton, OR 97005
(503) 229-4411

9252963
$479,379
Start: 9/1/92
(36 months)

Constructive Assessment: Study Equity, Validation and Communication

This 3-year project develops materials to enhance student equity through assessment as well as validation and communication aspects of alternative methods in mathematics. The activities enable the students to gain a more in-depth, relevant understanding of their own achievements. The activities investigate the needs, interpretations, and values of approximately 200 students who participate in alternative assessment activities within the constructivist Visual Mathematics programs. The project provides an integrative model for the constructive involvement of teachers, students, and technology in a broad range of assessment methods. It also provides a base of grounded theory for future research.

Descriptors: Assessing Student Learning, Constructivist Approach, Elementary School, Mathematics, Middle School

James J. Gallagher
Michigan State University
Department of Teacher Education
East Lansing, MI 48824
(517) 355-1855

9252881
$851,638
Start: 9/1/92
(36 months)

Using Assessment in the Service of Teaching and Learning in Middle School Science and Mathematics

This project develops a model that integrates assessment with mathematics and science instruction and a sample set of assessment techniques and strategies that exemplify the outcomes of implementing this model. Communities of professionals including mathematicians, scientists, a measurement expert, teachers, and State Department of Education representatives work collaboratively to develop the materials. These communities decide on learning goals in line with the newest definitions of science and mathematics literacy and determine what counts as evidence to indicate the extent to which these goals are met. The project also documents and analyzes this alternative collaborative process so that it can be used effectively in other settings.

Descriptors: Assessing Student Learning, Mathematics, Middle School, Science

Gary E. Dwoskin
Ray Shiflett (Co-PI)
National Academy of Sciences
2101 Constitution Avenue, NW
Washington, DC 20418
(202) 334-2254

9153997
$312,900
Start: 8/1/91
(24 months)

Study Group on Guidelines for Mathematics Assessment

The National Research Council's Study Group on Guidelines for Mathematics Assessment conducts a 2-year project consisting of three interrelated components. The first is the development of conceptual guides and principles to help states and local education agencies, as well as private groups, as they create assessment instruments and systems. The guides set forth in some detail the factors that such agencies must take into account, including choices of content, instrumentation, data analysis, and data reporting. The second component is an examination of technical measurement issues involved in alternative methods of assessment. The third component is a consideration of policy issues, including matters of the relative costs of various forms of assessment, the effects of changes in assessment on curriculum and classroom practice, and issues of fairness and bias.

Descriptors: Assessing Student Learning, Assessment Guidelines, Mathematics

Susan A. Agruso
New York State Education Department
Bureau of Science Education
75 Washington Avenue
Albany, NY 12234
(518) 474-7746

9154506
$1,219,064
Start: 11/15/91
(36 months)

New York State Science Assessment Project

This project develops innovative test questions (hands-on emphasis), statewide examinations, and teacher resources to help ensure that specific science learning outcomes are achieved. It is designed for grades 4 and 8 and for high school earth science and biology. Science assessment manuals are developed to help teachers prepare students for more challenging state examinations and to encourage more thoughtful and valid assessment of student learning.

Descriptors: Assessing Student Learning, Biology, Earth Sciences, Elementary School, High School, Middle School, Science, Teacher Materials

Heather McCollum
Policy Studies Associates, Inc.
1718 Connecticut Avenue, NW
Washington, DC 20009
(202) 939-9780

9154432
$496,480
Start: 12/1/91
(36 months)

Case Studies of the Introduction and Use of Portfolio Assessment in Precollege Mathematics Education

This project conducts a first large-scale national study of the introduction and use of portfolio assessment in precollege mathematics instruction. The goal is to identify principles that can inform continued policy and program development and that can stimulate new initiatives in assessment, curriculum, and instruction. The program also examines efforts and ways that portfolio assessment affects curriculum and instruction in mathematics.

Descriptors: Assessing Student Learning, Elementary School, High School, Mathematics, Middle School, Portfolio Assessment

Stephen P. Klein
Rand Corporation
Domestic Research Division
1700 Main Street
Santa Monica, CA 90406
(213) 393-0411

9154406
$3,269,290
Start: 12/1/91
(36 months)

Alternative Performance Assessment Systems: An Evaluation of Cost, Technical Quality, Feasibility, and Acceptability

This project examines the cost, technical quality, feasibility, and acceptability of alternative assessment systems (i.e., testing programs that include combinations of measures for making decisions about individuals, instructional programs, or state and national trends). The project gathers and analyzes data on the performance and other types of measures used by the California Assessment Project and other such programs. The program studies the statistical properties of these measures, the resources required to develop and use them, and the attitudes of students, teachers, and others toward their inclusion in testing programs. The project also develops other tasks from the same "shell." Data on these measures are used to investigate the sensitivity of these tasks to the effects of instruction and practice. The project discusses key features and implications of alternative assessment systems.

Descriptors: Assessing Student Learning, Attitudes, Elementary School, High School, Middle School

George J. Pallrand
Rutgers University
Graduate School of Education
10 Seminary Place
P.O. Box 5050
New Brunswick, NJ 08903-5050
(908) 932-7280

9150108
$701,088
Start: 5/15/91
(36 months)

Assessments for Science Teaching

This project develops new forms of assessment and teaching protocols for use by high school science teachers. Explanation-based and procedural-based assessments are presented via videotape. The assessment tools are based on teaching materials developed to introduce topics of current interest in science and technology into high school courses.

These science teaching materials have been developed by teams of university and industrial scientists working collaboratively with high school teachers through the Science Modules Program at Rutgers University. The program is extending selected materials to create innovative assessments and teaching protocols. These assessments are broadened for general use by high school science teachers. This project is conducted through the joint efforts of faculty and staff from Rutgers University and the Educational Testing Service.

Descriptors: Assessment, High School, Science, Teacher Materials, Technology Education, Videotape

Andrew A. Zucker
Edward T. Esty (Co-PI)
SRI International
1611 North Kent Street
Arlington, VA 22209-2192
(703) 247-8585

9054652
$376,801
Start: 3/15/91
(36 months)

A New Method of Assessing and Changing Students' Understanding of Mathematical Problem Solving

This project develops and tests 20–24 videotape scenarios based on realistic problem-solving situations. The tapes are used in two ways: (1) as assessment tools to measure students' problem-solving skills and beliefs and (2) as instructional devices to promote problem solving. The focus of the materials is on students' beliefs about problems and ways to solve them. The videotape scenarios show children involved in a cooperative effort to solve real-life problems.

The videotapes are used to develop the abilities of children in grades 4–6 to recognize problem situations, to develop problems from these situations, and then to solve the problems. Simultaneously, instruments are developed to assess students' understanding and dispositions about problem solving. All materials are indexed to the NCTM Standards.

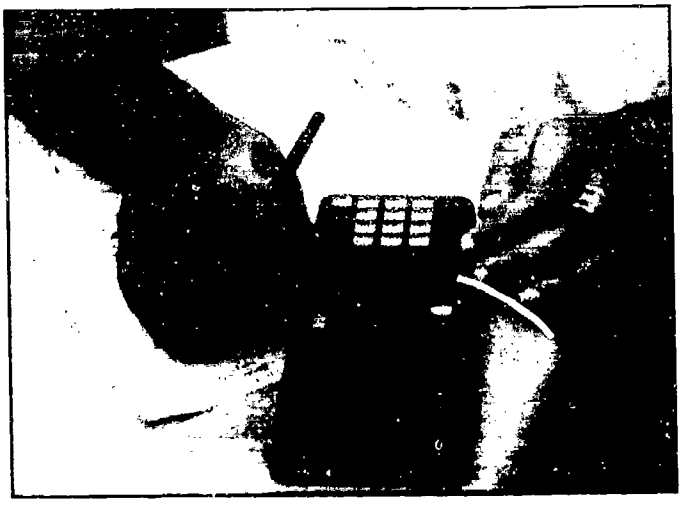
Descriptors: Assessment, Cooperative Learning, Elementary School, NCTM Standards, Problem Solving, Real-World Problems, Videotape

Edward H. Haertel
Stanford University
School of Education
Encina Hall
Stanford, CA 94305
(415) 723-2300

9154527
$162,429
Start: 12/1/91
(36 months)

Achievement and Assessment in School Science: Modeling and Mapping Ability and Performance

This 3-year project uses science performance test data collected under the auspices of the California Assessment Program (CAP) to refine and apply new methods for scoring performance tests and for modeling cognitive abilities. Staff members also work with CAP personnel to incorporate into future performance tests features that facilitate the forms of analysis proposed. The analytical methods developed involve modeling underlying abilities in terms of discrete states.



Task performance is represented in terms of discrete states, and mappings are derived from ability states to task performance states. Representations and mappings are in terms of partially ordered sets, distributive lattices, and related mathematical structures. Restricted latent class models are used to make inferences about true task performance state and true ability state in the presence of random classification errors.

Descriptors: Assessing Student Learning, Elementary School, High School, Performance Assessment, Science

Rodney L. Doran
State University New York, Buffalo
4240 Ridge Lea Road
Buffalo, NY 14260
(716) 831-3051

9155704
$24,902
Start: 12/1/91
(12 months)

Innovation Testing Science

This project examines the results of alternative assessment items in the sciences, developed at the Science Teaching Center in Israel, with secondary school students in the United States. It determines if further international cooperation is possible in developing the movement to complement multiple-choice test items with other forms of student assessments in the sciences.

Descriptors: Assessing Student Learning, High School, Science

Alan H. Schoenfeld
University of California, Berkeley
Graduate School of Education
Berkeley, CA 94720
(510) 642-6000

9252902
$3,656,479
Start: 7/1/92
(36 months)

Balanced Assessment for the Mathematics Curriculum

This project develops assessment materials for K–12 mathematics instruction that have broad national applicability. They serve not only as a means of measuring student attainment but also as a positive force for curriculum change. Materials include (1) assessment packages (for each of three grade ranges) that exemplify national goals, related state guidelines, and curricula funded through NSF's Instructional Materials Development; (2) explicit curriculum support, including both classroom materials and professional development resources, to facilitate the transition, thus enabling typical teachers to prepare their students to tackle new kinds of tasks before they take on comprehensive new curricula; (3) active collaborative links between the assessment designers and those concerned with the design and delivery of curricula (national curriculum development projects, the professional associations, states, and others who have similar curriculum objectives); and (4) a guide book that serves as a driving force for curriculum enhancement through the pressures generated by this assessment.

Descriptors: Assessing Student Learning, Elementary School, High School, Mathematics, Middle School

Jean-Claude Falmagne
University of California, Irvine
Irvine Research Unit in Mathematics
and Behavioral Science
Campus Drive
Irvine, CA 92717
(714) 856-5011

9350484
$2,281,478
Start: 9/1/93
(60 months)

An Expert System for the Efficient Assessment of Mathematical Knowledge

This project develops an interactive student assessment computer system to be used in grades 4–8. This expert system, where subsequent questions are based on previous responses, provides each student with a report, which is delivered in everyday language and which describes the student's current strengths and weaknesses relative to the appropriate mathematics curriculum. The report makes specific recommendations and provides a printout of critical question missed with annotated solutions. The results for each student are advisory to the classroom teacher. Each student session is completed in a short time. The system considers cultural and social diversity and is constructed to accept "open" responses to the questions. The system requires the identification and construction of a "knowledge space," which includes a suitable family of "knowledge states," revised and refined through peer review. Both the development and initial implementation take place in exemplary schools in Orange County, California.

Descriptors: Assessment, Computers, Mathematics, Middle School

Maryl Gearhart
University of California, Los Angeles
National Center for Research on
Evaluation Standards and Student Testing
405 Hilgard Avenue
Los Angeles, CA 90024
(213) 825-4321

9154512
$933,048
Start: 12/1/91
(48 months)

Portfolio in Practice: Integrating Assessment and Instruction in Elementary Mathematics

This project develops a model mathematics portfolio practice in which cycles of productive activity and assessment recur throughout curriculum units. The model is grounded in developmental psychology work that emphasizes social and cultural supports and the role of motivation in children's learning. Two studies are planned: (1) a trial of portfolio practice to refine it and the measures needed to evaluate it and (2) a systematic comparison among classrooms, a comparison that varies in curriculum approach and portfolio use to evaluate the impact of portfolio practice on classroom instruction and assessment, on teachers' knowledge of students' mathematical understandings and motivations, and on students' own understandings and motivations. Research measures include quantitative (group tasks, questionnaires) and qualitative individual tasks and interviews.

Descriptors: Assessing Student Learning, Elementary School, Mathematics, Middle School, Portfolio Assessment

James A. Shymansky
University of Iowa
Iowa City, IA 52242
(319) 353-2121

9252973
$300,306
Start: 6/1/92
(12 months)

Teaching and Testing to Promote Higher Order Thinking in Science and Mathematics Education

This project works with a high-stakes testmaker to develop outcome measures of higher order thinking processes, assists a group of science and mathematics teachers in preparing assessment strategies, studies the effects of those strategies on students' performance using the developed outcome measures and a related high stakes measure, and develops a teacher assessment in-service package which illustrates and explains sample classroom assessment strategies that promote higher order thinking.

Descriptors: Assessment, Elementary School, High School, Mathematics, Science

Richard A. Duschl
Drew Gitomer (Co-PI)
University of Pittsburgh
School of Education
4C12 Forbes Quad
Pittsburgh, PA 15260
(412) 648-1961

9055574
$669,009
Start: 8/1/91
(24 months)

Portfolio Culture: A Model for Interactive Science Instruction and Assessment

This project develops and evaluates a new model of instruction and assessment that fosters the construction of scientific meaning by students and that encourages conceptual development consistent with the growth of scientific knowledge. The development and implementation of a portfolio culture in science classrooms represent a fundamental change in teaching priorities, classroom practices, and institutional functions. This project is directed at evaluating and documenting how the adoption of a portfolio culture affects student performance, as well as teacher attitudes and practice.

This research has several outcomes: (1) setting classroom instructional guidelines that inform teachers about the selection and sequences of instructional tasks, (2) generating strategies to conduct formative assessment of students' knowledge bases, (3) providing recommendations for in-service education programs that strive to implement conceptual change teaching reforms, and (4) exploring ways that alternative assessment strategies can be used by other educational constituents to communicate learning outcomes. Educational Testing Service contributes substantial financial and staff resources to support initial phases of this work. The Pittsburgh Public School District contributes costs associated with participation by teachers and administrators.

Descriptors: Assessment, Evaluation, Portfolio Assessment, Science, Teacher Materials

James W. Pellegrino
Vanderbilt University
Learning Technology Center
512 Kirkland Hall
Nashville, TN 37240
(615) 322-8070

9252908
$1,954,380
Start: 6/1/92
(60 months)

SMART Assessments: Scientific Mathematical Arenas for Refining Thinking

This project develops assessment models and extends them via technology for teleconferencing to create frequent, intrinsically motivating assessment strategies. SMART assessment involves a series of stages focused on a Challenge Series in which students work on problems embedded into instructional units. Students use gained knowledge to evaluate answers and arguments. They receive immediate feedback and then work on new problems with the opportunity to respond again in a second Challenge Series teleconference program.

A series of studies evaluates the design features of SMART assessments and how these features enhance learning and the quality of teaching in the areas of science and mathematics. The model is first applied across curricular applications in mathematics particularly related to the NSF-funded *Adventures of Jasper Woodbury* series. The model is then applied to two other programs in science and mathematics. The materials include (1) a documented set of assessment design procedures with examples of applications emphasizing problem solving and reasoning in mathematics and science, (2) data from research studies investigating the implementation of such procedures in multiple classrooms with different teacher and student characteristics, (3) data on the impact of such assessment procedures on instructional program outcomes, and (4) analyses of the implications of the assessment for psychometric modeling and measurement.

Descriptors: *Adventures of Jasper Woodbury* Series, Assessing Student Learning, Elementary School, Mathematics, Middle School, Science, Technology, Teleconferencing

Conferences and Studies

F James Rutherford
American Association for the Advancement of Science (AAAS)
1333 H Street, NW
Washington, DC 20005
(202) 326-6400

9350003
$5,000,000
Start: 10/1/93
(48 months)

Project 2061: Education for a Changing Future

The AAAS is continuing its program of systemic reform in the teaching and learning of science, mathematics, and technology. Phase I, which started in 1985 and ended in 1989 with the publication of *Science for All Americans* (*SFAA*), described what a scientifically literate person should know about science. In addition to discipline-specific content, cross-cutting themes and habits of mind were described. Phase II is to provide an entirely new set of reform tools for educators to use to redesign curricula and schools to implement *SFAA*. Six school-based sites are to develop curriculum models based on inquiry, explanation, design, and issues which deliver the science of *SFAA* and to develop blocks of curriculum (about a quarter of a year long). Phase II aims also to provide a Framework for Curriculum Design, which is to be used by curriculum designers, school districts, test developers, and teacher educators, describes how to target desired learning outcomes in terms of inputs, constraints, options, and costs in a variety of approaches to implementing *SFAA*. The fourth part of phase II is a series of blueprints which recommend changes that need to be made in order for the curriculum and teaching reforms of Project 2061 to take hold and survive in the school setting. These blueprints include topics such as Teacher Education, Assessment, Materials and Technology, Curriculum Connections, School Organization, Parents and Community, Higher Education, Business and Industry, Educational Research, Equity, Educational Policy, and Finance. Other aspects of the project are funded by others.

Descriptors: Framework for Curriculum Design, Mathematics, Project 2061, Science, *Science for All Americans*, Systemic Reform, Technology

Shirley M. Malcom
American Association for the Advancement of Science (AAAS)
Office of Opportunities in Science
1333 H Street, NW
Washington, DC 20005
(202) 326-6680

9154017
$41,724
Start: 7/1/91
(12 months)

Wingspread Conference on Assessment in Science and Mathematics

This project provides an activity, including research, that builds upon the AAAS's "This Year In School Science" and "Assessing Higher Order Thinking In Mathematics." The research involves the collection of data supplied by the 50 State Education Officers regarding the status of each state in evolving "assessment of student learning" vis-a-vis science and mathematics. These data, and other data collected prior to a planned conference on this topic, serve to frame discussion. The conference should result in plans to share costs across states as the states continue to unfold activities in the area of assessment of student learning.

Descriptors: Assessing Student Learning, Conference, Science

Bonnie Brunkhorst
American Geological Institute (AGI)
4220 King Street
Alexandria, VA 22302
(703) 379-2480

9450512
$49,845
Start: 2/15/94
(17 months)

Planning "Earth-Science Education in the Community—Understanding Our Environment"

AGI proposes to coordinate the development of earth science curriculum and student learning materials for grades 7–12. In planning "Earth Science Education in the Community—Understanding Our Environment" ("EarthComm"), AGI will build on the strength of very successful earth science education projects, the AGI "Earth Science Curriculum Project" materials and "Earth Science Content Guidelines Grades K–12," as well as major science education curriculum and reform programs such as the American Association for the Advancement of Sciences' Project 2061. "EarthComm" will provide a complete earth science educational program that includes learning materials, teacher resources (both materials and teacher networks), and assessment tools for a hands-on, student inquiry-based, instructional program that is interdisciplinary and allows implementation in a modular format. The proposed project will also target the development of a strong mentor program to enhance the science teaching capabilities and leadership skills of teachers.

Descriptors: Earth Sciences, Mentoring, Modules, Project 2061, Science, Teacher Materials

Kenneth Ford
Bernard V. Khoury (Co-PI)
American Institute of Physics
355 East 45th Street
New York, NY 10017
(516) 349-7800

9255863
$275,000
Start: 4/15/93
(12 months)

XXIV International Physics Olympiad

The American Institute of Physics (AIP) and the American Association of Physics Teachers (AAPT) were hosts to the XXIV International Physics Olympiad in Williamsburg, Virginia, in July 1993. The Olympiad, held annually in a different country, provided opportunity for five students from each of about 40 countries to participate in an international competition. The Olympiad was a 7-day event and consisted of a theoretical examination of three questions to be answered in 5 hours and an experimental investigation to be done in about 4 hours. Also included in this Olympiad were field trips to Busch Gardens, Williamsburg, and CEBAF, time to interact, and ceremonial events. The examination was critiqued, translated, graded, and discussed with the team leaders from all countries during the Olympiad. The selection process in the United States gave opportuni-

ty for over 600 students and their teachers to become acquainted with the world-class physics problems. The AIP did the fund raising and the AAPT planned, organized, and implemented the Olympiad. To illustrate what is meant by "world-class," the problems used to select the U.S. team are published in a magazine for physics teachers.

Descriptors: Experimental Investigation, Olympiad, Physics

Joseph D. McInerney
Biological Sciences Curriculum Study (BSCS)
830 N. Tejon, Suite 405
Colorado Springs, CO 80903
(719) 578-1136

9354091
$49,831
Start: 8/1/93
(12 months)

Rethinking the Role of Science Curriculum Development Organizations

BSCS will complete this project in three phases. The first phase involves commissioning short papers on the general theme of curriculum development. The papers will consider different questions and provide a provocative and creative, yet scholarly, basis for the conference. Each author will present his or her ideas in a short, editorial-length paper. The authors for these editorials will not be from major curriculum-development groups. The papers will be distributed prior to the conference and included in the monograph. Representatives from both national and local curriculum development groups also will prepare short editorials on their respective organizations and the priorities, changes, and projections for the next decade. In particular, they will address (1) their long-range organizational plans, (2) their responses to the standards-based reform, (3) the factors that facilitate and inhibit curriculum development, and (4) the issues and problems they expect in the next decade.

Descriptors: Paper Presentations, Research Study

Rodger W. Bybee
Gordon E. Uno (Co-PI)
Biological Sciences Curriculum Study (BSCS)
Department of Biological Sciences
Colorado Springs, CO 80903
(719) 578-1136

9150808
$231,228
Start: 7/15/91
(18 months)

Development of Biology Curriculum Frameworks for High School, 2-Year and 4-Year Nonmajors Courses

Articulating biology education and reform of undergraduate programs for nonmajors requires clarifying fundamental biological concepts, recognizing the unique characteristics of institutions, and considering the role and influence of precollege education in the life sciences. To provide a biology curriculum framework for high school, 2-year and/or 4-year nonmajor courses, the Biological Science Curriculum Study conducted a study of biology education at precollege and college levels.

The goals of the study were to elaborate the conceptual structure of biology and to determine appropriate curriculum frameworks for high school, community college, and undergraduate courses for nonmajors. The development of curriculum frameworks for collegiate courses for nonmajors biology will provide substantial leadership for the biology education community. The concurrent development of high school programs based on a similar conceptual framework will also help to accomplish the objective of bridging the gap between precollege and undergraduate science. Because the undergraduate program includes 2-year colleges, large numbers of women and minority students may be served—groups that are currently underserved by science education.

The study relied on experts to identify and clarify the major concepts of biology and recommend curriculum frameworks for precollege and college programs. The recommendations of this study were published and have been disseminated to professional societies in biology and biology education for further distribution.

Descriptors: Biology, Book, Curriculum, Framework, High School, Postsecondary

Solomon A. Garfunkel
Consortium For Mathematics and Its Applications (COMAP)
60 Lowell Street
Arlington, MA 02174
(617) 437-5640

9354099
$50,000
Start: 9/15/93
(11 months)

Gateways II

Gateways II is a conference to be held in Boston, Massachusetts, October 1–3, 1993, to bring together the curriculum developers from all of the National Science Foundation funded elementary, middle, and secondary school comprehensive mathematics curriculum projects. They share information, experiences, and address common questions which have arisen as materials and curricula have been produced. In addition, questions of evaluation, teacher enhancement, and implementation are addressed. The interaction of the developers of these projects is to provide better materials more expeditiously which can be implemented in schools.

Descriptors: Conference, Elementary School, Evaluation, High School, Implementation, Mathematics, Middle School, NCTM Standards, Teacher Enhancement

Glenn M. Kleiman
Education Development Center (EDC), Inc.
55 Chapel Street
Newton, MA 02160
(619) 965 6325

9453671
$40,837
Start: 7/1/94
(18 months)

A Study of "Seeing and Thinking Mathematically" Units with Linguistically and Culturally Diverse Students

This project focuses on two current issues in American education: reform in mathematics education led by the National Council of Teachers of Mathematics Standards and the need to serve a linguistically and culturally diverse student population. The implementation

of the unit "Language of Numbers" developed by the Education Development Center under a previous National Science Foundation award is evaluated in schools served by the California Middle School Mathematics Renaissance of the California State Systemic Initiative. This unit, designed for 6th grade, includes material on number representational systems, multiple representations of numbers, and number representational devices. In addition, it focuses on investigation, invention, symbolization, and communicating mathematically. The evaluation consists of classroom observations; individual and focus-group interviews with teachers, students, administrators, and parents, and review of student work. The outcome comprises (1) general principles for the design and implementation of instructional materials for linguistically and culturally diverse students and (2) guidance for teachers implementing similar instructional materials.

Descriptors: Assessment, Communications Skills, Language, Mathematics, Middle School, NCTM Standards, Numbers

Molly Watt
Education Development Center (EDC), Inc
55 Chapel Street
Newton, MA 02160
(619) 965-6325

9253030
$153,415
Start: 7/1/92
(24 months)

Action Research: Purposes, Practices, Possibilities—Creating Links to National Science

This proposal links action research with three education-reform initiatives for this decade: (1) the push for new professional roles for teachers, (2) the revitalized reform movements in mathematics and science education, and (3) the need to reframe the current practices in teaching and assessing learning along a more constructivist approach. Action research, which is usually undertaken by teachers to improve their own practices, can make greater contributions to each of these agendas. Despite significant local projects throughout the world, action research has remained outside mainstream science and mathematics education-reform efforts. This project will bring together for a one-weekend working conference 35 participants who represent multiple perspectives in the fields of math, science, teacher development, and research methodology and who play key roles in education reform: teachers, school administrators, research methodologists, policy makers, and teacher educators. Conference participants will define action research as it applies to American education, identify its enabling conditions, and create a vision of its potential to support renewal in science and math education. Expected outcomes of the conference will be (1) a strong network of colleagues knowledgeable about how action research can facilitate reform; (2) ongoing telecommunications among participants during project development and as follow-up to new initiatives, (3) recommendations for ways that action research can support reforms in science and mathematics education, disseminated through professional organizations; (4) a monograph that encompasses current theory and practice of action research; and (5) a new methodology for linking small, context-specific research by teachers for the purpose of informing larger educational decision-making.

Descriptors: Action Research, Conference, Constructivist Approach

Rosalea Courtney
Educational Testing Service
Rosedale Road
Princeton, NJ 08541
(609) 734-5679

9353674
$47,625
Start: 6/1/93
(12 months)

SGER: What Intermediate Students Learn From Science Fairs

This exploratory study investigates ways to document what children learn from their participation in local science fairs. Students' understanding of the process and elements that make up a science fair project as well as direct learning of science content related to their science fair topic are evaluated though several different methodologies. Comparative analysis is made of indicators of children's learning yielded by these different approaches. This study is conducted in 4th and 5th grade classrooms in both an urban and a suburban school district. From 75 to 100 students at each grade level participate in the study. The sample is balanced with equal numbers of boys and girls. The project is significant because it uses a variety of strategies to assess what children have learned and who has benefitted most from participation in a local science fair. The assessment strategies are more informative to the instructional and evaluative decisions that teachers must make regarding science learning and assessment for older elementary school students.

Descriptors: Assessment, Elementary School, Middle School, Research in Student Learning, Science Fairs

Margaret Jamison
Ferrum College
Ferrum, VA 24088
(703) 365-2121

9153709
$16,817
Start: 11/1/91
(12 months)

Shaping 7th Grade Mathematics in an Information Society

This planning grant is for the development, implementation, and evaluation of materials for middle school mathematics. It is anticipated that a full proposal will be submitted to Instructional Materials Development at the end of this project. The principal investigator proposes to become involved in the efforts of successful programs in curriculum development, to study available materials, and to make contacts with other mathematics educators by means of the National Council of Teachers of Mathematics and other professional meetings.

Descriptors: Mathematics, Middle School

James Greeno
Institute for Research on Learning
3333 Coyote Hill Road
Palo Alto, CA 94304
(415) 494-4070

9450522
$50,000
Start: 7/15/94
(18 months)

Research for Reforming Education

By means of interviews and other communication with researchers and developers who are engaged in efforts toward educational reform in mathematics, this project studies ways in which research can play a

more productive role in educational reform, particularly in mathematics as taught in the Middle School Mathematics Projects (MMAP). The study is based on the assumption that practice can be guided by examples that are communicated as generalizable models. Generality is facilitated by analyses that identify the factors needed for models to succeed and that assist in applying models to local circumstances.

Descriptors: Mathematics, Middle School, Research

Shelley Goldman
Institute for Research on Learning
3333 Coyote Hill Road
Palo Alto, CA 94304
(415) 494-4070

9452864
$50,000
Start: 10/1/94
(5 months)

Gateways III: Moving Forward

Gateways III is a conference to be held in San Francisco, California, October 6–8, 1994, to bring together curriculum developers from all of the National Science Foundation funded elementary, middle, and high school comprehensive mathematics curriculum projects. They share information and experiences and address common problems that have arisen as materials have been developed, tested, and implemented. This conference will feature increased interaction with teachers and educators who are involved in classroom implementation of mathematics education reform. The conference schedule includes visits to classrooms, project poster sessions, break-out sessions, and panel discussions. Implementation will be a major theme of the conference.

Descriptors: Conference, Elementary School, High School, Implementation, Mathematics, Middle School

William Dugger, Jr.
International Technology Education Association
1919 Association Drive
Reston, VA 22091
(703) 860-2100

9355826
$500,000
Start: 9/1/94
(24 months)

Technology for All Americans

Standards for technology education are needed to complement the national standards in mathematics and science. The first phase of the project is to articulate a rationale and structure for technology education—a vision for the intellectual domain for technology education and its interface with science and mathematics. The International Technology Education Association (ITEA) develops the documents and the processes for evaluating technology education to gain consensus and acceptance by the technology education community and other constituencies. An advisory board of people with national reputations in various fields oversees the process.

Descriptors: Standards, Technology Education

James R. Leitzel
Mathematical Association of America (MAA)
1529 18th Street, NW
Washington, DC 20036
(202) 387-5200

9154004
$50,000
Start: 7/1/91
(12 months)

Conference on Research in Collegiate Mathematics Education

In this project, the MAA conducts a conference around the issues in improving education in mathematics for undergraduates in colleges and universities. Among the issues considered are (1) effective ways to communicate to college and university faculty the growing body research in undergraduate mathematics education; (2) effective ways to stimulate the college and university environment so that the research findings in (1) may be implemented in classrooms; and (3) effective ways for faculty who undertake research in teaching and learning to find support and encouragement.

The result of the conference is a long-range strategic plan that is to be published as a Conference Report by the MAA. The report is distributed to the chairs of all mathematical science departments. Furthermore, articles which summarize the conference appear in both *FOCUS* and *UME Trends*. Representatives from the various mathematical societies, the American Mathematical Society, the Mathematical Association of America, and the National Council of Teachers of Mathematics participate in the conference.

Descriptors: Conference, Mathematics, Postsecondary

Robert Swartz
National Center for Teaching Thinking
815 Washington Street, Suite 8
Newtonville, MA 02160
(617) 965-4604

9452805
$70,000
Start: 8/11/94
(4 months)

Teaching Critical Thinking and Problem Solving in Science and Mathematics: A Request for Funding

This proposal seeks funds to conduct a "Conference on Improving the Quality of Thinking in a Changing World," to be held at the Massachusetts Institute of Technology, July 17–22, 1994. The primary objectives of this conference are to present the latest findings on research and practice on teaching critical thinking, problems-based learning, and the use of advanced technology to enhance thinking. The general format is to present topical information in modules with

complementary working sessions. These working sessions are to be directed toward the establishment of priorities for further research and for the development of relevant and effective models of instruction which will foster critical thinking and problem-solving skills. Teachers are to be major participants in the conference and postconference activities.

Descriptors: Conference, Critical Thinking, Problem Solving, Research, Science Education

Gail Burrill
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091
(703) 620-9840

9255275
$49,767
Start: 5/1/92
(12 months)

Algebra for the Twenty-First Century: A Conference for Mathematics Educators

This grant was for a conference held August 1–5, 1992. The conference examined the issues facing the reform of algebra. The participants were classroom teachers, mathematics educators, university mathematicians, and curriculum developers. The proceedings from the conference were published. Participants also included representatives from the calculus reform movement to help in the interface between high school and college. Issues addressed at the conference included (1) what is algebra? (2) how should assessment be changed? (3) how does algebra fit in an integrated curriculum? and (4) how can change be implemented?

Descriptors: Algebra, Assessment, Conference, High School, Integrated Curricula, Mathematics

William W Reynolds
Reynolds & Schaeffer
P.O. Box 265
Haddonfield, NJ 08033
(609) 428-6700

9253093
$114,881
Start: 6/15/92
(12 months)

Dissemination of Instructional Materials in Science for the Precollege Level: A Report to the Profession

Reynolds & Schaeffer worked with Instructional Materials Development Program staff to select between 10 science projects that are presently funded, or have been funded, by the program in the past decade and have been judged to be successful according to the limited objectives of the individual project evaluations. Reynolds & Schaeffer recruited and coordinated a team of professionals with significant expertise in the science field who have successfully served in the past projects. This team analyzes the data and files individual reports for each project. These reports are synthesized into a single coherent report on the impact of NSF-funded instructional materials on formal and informal teaching and learning in the field of science and technology across the nation.

Descriptors: Developers, Impact Study, Report, Science, Teachers

Evan Ferguson
Sigma XI Scientific Research Society
Research Triangle Park, NC 27709
(919) 549-4691
Fax: (919) 549-0090

9450513
$74,848
Start: 3/15/94
(17 months)

Scientists, Educators, and National Standards: Action at the Local Level

This project seeks funds to support a science education forum entitled "Scientists, Educators, and National Standards: Action at the Local Level," to address the issue of national standards and the issue of how scientists from universities, government, and other institutions can contribute to the success of the standards and the proposed science reform. Efforts are to be made to determine how scientists and engineers might best help to improve science education in their local schools. The building of partnerships between scientists, engineers, and K–12 teachers will be a major thrust of this forum.

Descriptors: Conference, NCTM Standards

John Boynton
Raymond Morris (Co-PI)
Society of Automotive Engineers, Inc
400 Commonwealth Drive
Warrendale, PA 15096
(412) 776-4841

9350544
$82,546
Start: 4/15/93
(12 months)

All Systems Go—A Conference

The Society of Automotive Engineers is studying the feasibility for the development of three intensive units for grades 6 through 8, around which the entire curriculum could be integrated for a few weeks. The units take the form of automotive engineering design experiences: exploring automotive systems, flight technology, and ground transportation. The materials would be targeted to specific grade levels and engage multiple community resources in dynamic ways. The goals of the planning period are to form collaborations with the other major national curriculum groups, educational researchers, and middle school personnel and to develop the prototype of the technological challenges that form the core of the integrated learning experience. Based on their experience with The World in Motion, the principal investigators estimate that the project reaches about 10 percent of the student body nationally through interactions with engineers in corporations and universities. The goals of the project also include the long-term collaboration of businesses, professional societies, and universities; the involvement of individual engineers with the education of middle school students; and the encouragement of a greater diversity of students to consider engineering as a career. During the planning period, a program development office will be established, a planning conference to establish the collaborations will be held, a prototype will be developed and evaluated, and a proposal for developing the curriculum units will be prepared.

Descriptors: Careers, Conference, Engineering, Mathematics, Middle School, Multidisciplinary, Science, Technology Education

R. Stephen Berry
Telluride Summer Research Center
P.O. Box 2255
Telluride, CO 81435
(619) 698-2167

9255709
$21,540
Start: 7/15/92
(12 months)

Bringing the Arts into the Sciences

This project develops prototype materials bringing the methods of the graphic, plastic, and dramatic arts to the teaching of sciences—three topics in science which are common to the experience of middle school or high school students and are topics of current research in science. The materials are for teachers to implement in classes the following year. The materials have input from students in a separate, concurrent summer program at the same location. The participants are teachers and MacArthur Fellows. The MacArthur Foundation co-funds the workshop. The results of the workshop may result in the production of more materials using the methods of the graphic arts in the study of science.

Descriptors: Art, High School, Middle School, Science, Thematic Units, Workshop

---

Robert F. Tinker
Technical Education Research Center (TERC), Inc
2067 Massachusetts Avenue
Cambridge, MA 02140
(617) 547-0430

9354097
$118,147
Start: 9/15/93
(12 months)

EDGIS Conference: Educational Applications of GIS

Geographic Information Systems (GIS) are collections of spatially aggregated data and programs to manipulate the data to answer questions in geography, earth science, environmental science, and other disciplines. These systems have the potential to make major contributions to what students learn and how they learn it. In a 3-day workshop, those who develop and study GIS, those who use GIS in research in various disciplines, and educators are brought together to obtain an understanding of GIS and its potential uses in education. The workshop consists of written papers to form the basis for discussion, plenary talks, breakout sessions, and demonstrations. The issues include technical (the present and future state of GIS), educational (disciplines, examples, costs, teacher enhancement), and cognitive science (what new concepts and processes students can learn). The conference provides a consensus of the potential for GIS in schools and an outline of the steps to reach that potential.

Descriptors: Conference, Earth Sciences, Environmental Science, Geography, Workshop

---

Lauren Williams
Triangle Coalition Tech
5112 Berwyn Road (3rd Floor)
College Park, MD 20740
(301) 474-0488

9353104
$238,228
Start: 9/1/94
(18 months)

Alliance Network Development for Implementation of Science Standards

This project will use the alliance in the Triangle Coalition to implement and disseminate communication strategies for education reform in science and mathematics. Selected communities will develop and test communication strategies in support of reform and work with the Triangle Coalition to build community involvement and support for new directions in mathematics and science education.

Descriptors: Dissemination

Louis Dale
University of Alabama
Department of Mathematics
University Station
Birmingham, AL 35294
(205) 934-4011

9255384
$132,376
Start: 7/15/92
(24 months)

Mentor Guidebook Materials Development

This project develops a guidebook to assist mentoring activities of middle school math and science teachers. The guidebook includes techniques and suggestions for effective mentoring. The first draft was completed in fall 1992. A group of teachers in the Birmingham area serves as mentors to teachers selected by their principals and uses the first draft to assist them. These teachers have already completed a separate teacher enhancement workshop on improvement of subject-matter content, teaching skills, and mentoring.

Descriptors: Guidebook, Mathematics, Mentoring, Middle School, Student Activities, Teacher Enhancement

---

Richard J. Saykally
University of California, Berkeley
Department of Chemistry
Berkeley, CA 94720
(510) 642-8264

9255389
$37,870
Start: 6/1/92
(8 months)

The York Conference

Ten teachers and science educators attended a workshop in the United Kingdom in July 1992 to see the Salter's Science Program in action and work with science educators there to transcribe units for 10th grade science to be used in the United States. The Salter's Science Program has integrated science in grades 6–10 and uses a thematic approach. It is particularly intriguing because some 9th grade units tested in some schools of the California Hundred Schools Project (National Science Teachers Association Scope, Sequence, and Coordination) have been enthusiastically received. The units reflect the Scope, Sequence, and Coordination model and provide exemplars for materials that need to be developed. The workshop also addressed the needs of teachers in teaching these materials.

Descriptors: Conference, Interdisciplinary, Middle School, Salter's Science Program, Teachers

---

James Fey
University of Maryland, College Park
College Park, MD 20742
(301) 454-3311

9453874
$25,620
Start: 4/15/94
(8 months)

Research in Mathematics Education: An ICMI Conference

The International Commission on Mathematics Instruction (ICMI) will hold an invitational international working conference in College Park, Maryland, May 8–11, 1994. Results will be disseminated to the broader research community in the United States and around the world and to concerned mathematicians, teachers, teacher educators, and curriculum developers. The National Science Foundation grant will be used to support travel and subsistence of participants, to enable the conference to engage the best researchers from around the world.

Descriptors: Conference, Mathematics

Sandra H. Fradd
University of Miami
University Station
Coral Gables, FL 33124
(305) 284-2210

9255830
$24,823
Start: 8/1/92
(12 months)

Describing and Comparing the Linguistic Performance, Cognitive Strategies, and Science Knowledge of Non-English–Background Students

This project is an exploratory study designed to obtain data on performance of problem-solving tasks by four groups of ethnolinguistic students: nonlingual English speakers, bilingual English–Spanish speakers, bilingual English–Haitian-Creole speakers, and African-American English speakers. The research observes, describes, and compares students' linguistic performance, use of cognitive strategies, and demonstration of science knowledge. This leads to further research and development, both of which advance knowledge in anthropology and cognition and relate this advancement to improvement of science instruction for students with limited proficiency in English.

Descriptors: Anthropology, Elementary School, Language, Problem Solving, Science

Rick Billstein
University of Montana
Department of Mathematical Sciences
Missoula, MT 59812
(406) 243-0211

9255857
$42,875
Start: 8/1/92
(12 months)

Mathematical Gateways: A Conference for Funded Mathematics Curriculum Projects, K–12

This grant was for a conference held October 2–4, 1992, for senior staff of funded projects that are developing full mathematics curriculum at one of the levels, elementary school, middle school, or high school. The conference enabled the project personnel to communicate with each other and build on materials developed for students by other projects. The participants also addressed common problems, planned articulation across grade levels, worked toward compatibility rather than competitiveness, and discussed strategies for common areas of concern such as assessment, evaluation, parental involvement, multicultural approaches, and the role of publishers

Descriptors: Conference, Elementary School, High School, Mathematics, Middle School

Robert G. Fuller
University of Nebraska, Lincoln
Department of Physics and Astronomy
14th and R Streets
Lincoln, NE 68588
(402) 472-2790

9253138
$52,471
Start: 4/1/92
(6 months)

Creating CD-ROMs for Science Education

An invitational, 3-day conference was held at the Cheyenne Mountain Conference Center in Colorado Springs April 1–3, 1992, to examine the present state of CD-ROM technology and applications. Issues such as rights, permissions, and royalties; conversion from print to magnetic format; software/user interface; and interactions with the CD-ROM industry were discussed. The conference published a conference report, which served as an introduction to CD-ROMs and their potential for use in education. To make the medium easier for the teacher to use, the conference recommended a set of common features in CD-ROMs that are designed for education. A group of educators was organized to interact with representatives of CD-ROM industries to encourage the effective use of CD-ROMs in education. The participants included representatives from industries and researchers in the field of CD-ROM development and representatives from the National Science Foundation and the Department of Education.

Descriptors: CD-ROM, Conference, Developers, Policy

Norman Webb
University of Wisconsin, Madison
750 University Avenue
Madison, WI 53706
(608) 262-1234

9252727
$100,745
Start: 5/15/92
(12 months)

Dissemination of Instructional Materials in Mathematics for the Precollege Level: A Report to the Profession

This project pulls together existing data on the impact of 10 selected past and current projects funded through Instructional Materials Development in the area of mathematics. These data are collected through questionnaires and interviews with project principal investigators, publishers, school personnel, and others. The project principal investigators are college faculty, publishing corporation representatives, researchers, directors of informal science instructional facilities, and officers of professional organizations all of whom have concern for the improvement of mathematics education at the precollege level. The results of these impact studies will serve Instructional Materials Development and the nation in setting directions for future funding and in designing more complete studies in the future.

Descriptors: Elementary School, High School, Mathematics, Middle School

Principal Investigator/Co-Principal Investigator index

Institution Index

Keyword Index

Technology Education Grants

GETTING NSF INFORMATION AND PUBLICATIONS

The National Science Foundation (NSF) has several ways for the public to receive information and publications. Electronic or printed copies of the NSF telephone directory, abstracts of awards made since 1989, and many NSF publications are available as described below. To access information electronically, there is no cost to you except for possible phone and Internet access charges. Choose the method of access that matches your computer and network tools. For general information about Internet access and Internet tools, please contact your local computer support organization.

WORLD WIDE WEB: NSF HOME PAGE

The World Wide Web (WWW) system makes it possible to view text material as well as graphics, video, and sound. You will need special software (a "web browser") to access the NSF Home Page. The URL (Uniform Resource Locator) is ***http://www.nsf.gov/.***

INTERNET GOPHER

The Internet Gopher provides access to information on NSF's Science and Technology Information System (STIS) through a series of menus. To access the Gopher, you need Gopher client software; the NSF Gopher server is on port 70 of ***stis.nsf.gov***.

ANONYMOUS FTP (FILE TRANSFER PROGRAM)

Internet users who are familiar with FTP can easily transfer NSF documents to their local system for browsing and printing. The best way to access NSF information is to first look at the index (file name: **index.txt**). From the index, you can select the files you need. FTP instructions are:

- FTP to ***stis.nsf.gov***.
- Enter **anonymous** for the user name, and your e-mail address for the password.
- Retrieve the appropriate file (i.e., **filename.ext**).

E-MAIL (ELECTRONIC-MAIL)

To get documents via e-mail, send your request to the Internet address ***stisserve@nsf.gov***. The best way to find NSF information is to request the index. Your e-mail message should read: **get index.txt**. An index with file names will be sent to you. However if you know the file name of the document you want, your e-mail message should read: **get <filename.ext>**.

E-MAIL MAILING LISTS

NSF maintains several mailing lists to keep you automatically informed of new electronic publications. To get descriptions of the mail lists and instructions for subscribing, send your request to: ***stisserve@nsf.gov***. Your message should read: **get stisdirm.txt**.

ON-LINE STIS

NSF's Science and Technology Information System (STIS) is an electronic publications dissemination system available via the Internet (telnet to ***stis.nsf.gov***); you will need a VT100 emulator. The system features a full-text search and retrieval software (TOPIC) to help you locate the documents. Login as **public** and follow the instructions on the screen.

To get an electronic copy of the "STIS USERS GUIDE," NSF 94-10, send an e-mail request to: ***stisserve@nsf.gov***. Your message should read: **get NSF9410.txt**. For a printed copy of the "STIS USERS GUIDE," see instructions "How To Request Printed NSF Publications."

NON-INTERNET ACCESS VIA MODEM

If you do not have an Internet connection, you can use remote login to access NSF publications on NSF's on-line system, STIS. You need a VT100 terminal emulator on your computer and a modem.

- Dial **703-306-0212**,
- choose 1200, 2400, or 9600 baud,
- use settings 7-E-1, and
- login as **public** and follow the on-screen instructions.

HOW TO REQUEST PRINTED NSF PUBLICATIONS

You may request printed publications in the following ways:

- send e-mail request to: ***pubs@nsf.gov***
- fax request to: **703-644-4278**
- for phone request, call: **703-306-1130** or Telephonic Device for the Deaf (TDD **703-306-0090**)
- send written request to:
  NSF Forms and Publications Unit
  4201 Wilson Boulevard
  Room P-15
  Arlington, VA 22230

When making a request, please include the following information:

- NSF publication number;
- number of copies; and
- your complete mailing address.

QUESTIONS ABOUT NSF PUBLICATIONS, PROGRAMS, ETC.

Contact the NSF Information Center if you have questions about publications, including publication availability, titles, and numbers. The NSF Information Center maintains a supply of many NSF publications for public use. You may:

- visit the NSF Information Center, located on the second floor at 4201 Wilson Blvd., Arlington, Virginia.; or
- call the NSF Information Center at **703-306-1234**; or **703-306-0090** for TDD; or
- send e-mail message to ***info@nsf.gov***.

QUESTIONS ABOUT THE ELECTRONIC SYSTEM

Send specific, system-related questions about NSF electronic publication services that are not answered in this flyer, to ***webmaster@nsf.gov*** or call **703-306-0214** (voice mail).

NSF 95-64 (Replaces NSF 94-4)

NATIONAL SCIENCE FOUNDATION
ARLINGTON, VA 22230

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

RETURN THIS COVER SHEET TO ROOM P35 IF YOU DO NOT WISH TO RECEIVE THIS MATERIAL ☐ , OR IF CHANGE OF ADDRESS IS NEEDED ☐ , INDICATE CHANGE INCLUDING ZIP CODE ON THE LABEL (DO NOT REMOVE LABEL).

BULK RATE
POSTAGE & FEES PAID
National Science Foundation
Permit No. G-69

NSF 95-123

(Replaces NSF91-96)