DOCUMENT RESUME

ED 384 518 SE 056 469

TITLE	Promising Practices in Mathematics and Science Education--1995: A Collection of Promising Educational Programs & Practices from the Eisenhower Mathematics and Science Regional Consortia.
INSTITUTION	National Network of Eisenhower Regional Consortia and National Clearinghouses.; Research for Better Schools, Inc., Philadelphia, Pa.
SPONS AGENCY	Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE	95
CONTRACT	R168R20012
NOTE	174p.
AVAILABLE FROM	Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education, Research for Better Schools, 444 N. Third St., Philadelphia, PA 19123 (Free while supplies last).
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC07 Plus Postage.
DESCRIPTORS	Demonstration Programs; Elementary Secondary Education; Higher Education; *Mathematics Education; National Programs; *Science Education; Teacher Education
IDENTIFIERS	*Dwight D Eisenhower Math and Science Educ Program

ABSTRACT

This volume of 50 promising programs and practices in mathematics and science education provides an array of innovative ideas of interest to K-12 teachers and persons involved in teacher education. These models of programs and practices can be used to improve teaching and learning in mathematics and science education. They can also be used to modify and adapt one's own practices in the classroom, to prepare on-going professional development experiences to improve and increase the effectiveness of practices already being used, and to suggest ways in which teachers can collaborate with developers to produce new and better practices. In addition, this publication includes an annotated listing of 67 practices selected for the 1994 edition, as well as effective practices recognized by the U.S. Department of Education. Also included is information about the National Diffusion Network, the Eisenhower National Clearinghouse for Mathematics and Science Education, and promising practices from the Laboratory Network Program. The programs are arranged in alphabetical order and contain the following information: subject, target audience, general description, grade level, teaching strategies, assessment tools, evidence of effectiveness, resources needed for implementation, contact information, site(s), and the Eisenhower regional consortium that submitted the entry. (MKR)

EISENHOWER REGIONAL CONSORTIA

Promising Practices in Mathematics and Science Education–1995

A Collection of Promising Educational Programs & Practices from the Eisenhower Mathematics and Science Regional Consortia

Sponsored by:
U.S. Department of Education
Office of Educational Research and Improvement

Promising Practices in Mathematics and Science Education-1995

A Collection of Promising Educational Programs and Practices from the Eisenhower Regional Consortia

Sponsored by:
U.S. Department of Education
Office of Educational Research and Improvement

National Network of Eisenhower Regional Consortia and National Clearinghouse

Eisenhower Math / Science Consortium at the Appalachia Educational Laboratory
Appalachia Educational Laboratory
Charleston, WV

Far West Regional Consortium for Science and Mathematics
Far West Laboratory
San Francisco, CA

High Plains Consortium for Science and Mathematics
Mid-continent Regional Educational Laboratory
Aurora, CO

Midwest Consortium for Mathematics and Science Education
North Central Regional Educational Laboratory
Oak Brook, IL

Northwest Consortium for Mathematics and Science Education
Northwest Regional Educational Laboratory
Portland, OR

Pacific Mathematics and Science Regional Consortium
Pacific Regional Educational Laboratory
Honolulu, HI

Eisenhower Regional Alliance for Mathematics and Science Education Reform
Regional Laboratory for Educational Improvement of the Northeast and Islands
Andover, MA

Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education
Research for Better Schools
Philadelphia, PA

SERVE Mathematics and Science Regional Consortium
SouthEastern Regional Vision for Education
Tallahassee, FL

Southwest Consortium for the Improvement of Mathematics and Science Teaching
Southwest Educational Development Laboratory
Austin, TX

Eisenhower National Clearinghouse for Mathematics and Science Education
The Ohio State University
Columbus, OH

This publication is sponsored wholly or in part by the U.S. Department of Education, Office of Educational Research and Improvement under contract/grant numbers: R168R20001, R168R20004, R168R20008, R168R20009, R168R20012, R168R20014, R168R20018, R168R20022, R168R20025, RP91002003. The content of this publication does not necessarily reflect the views of the department or any other agency of the U.S. Government.

This publication is available from your Regional Eisenhower Consortium (see page vii).

FOREWORD

I am pleased to present the second volume of promising practices in mathematics and science education, developed by the ten regional Eisenhower consortia funded by the U.S. Department of Education's Office of Educational Research and Improvement (OERI). This publication follows the 1994 publication which identified 67 promising practices in mathematics and science.

Both of these collections of programs emerged from a broad-based search, nomination, and review process involving many educators throughout the United States. Mathematics and science teachers and other reviewers from higher education institutions, state and local education agencies, regional educational laboratories and consortia, museums, foundations, associations, and other organizations selected the 50 promising practices presented in this guide from among the hundreds that were nominated for consideration. The criteria that reviewers used in selecting these practices are outlined on page v.

This volume of promising practices in mathematics and science education provides an array of innovative ideas which should be of interest to teachers at the elementary, secondary, and pre-service levels of education. These models of programs and practices can be used to improve teaching and learning in mathematics and science education. They can also be used to modify and adapt one's own practices in the classroom; to prepare on-going professional development experiences that improve and increase the effectiveness of the practices already being used; and to suggest ways in which teachers can collaborate with developers to produce new and better practices which may one day appear in a future volume of promising practices.

In addition, this publication includes an annotated listing of the practices previously selected as well as effective practices recognized by the U.S. Department of Education. Also included is information about the Eisenhower National Clearinghouse, which provides K-12 teachers with information on mathematics and science curriculum materials.

Because we are committed to the educational needs of our students, and the expectations and requirements for teachers are so great, we must draw upon the best that is known about effective instruction in mathematics and science education. The nation's citizens expect no less, and I am pleased that the Office of Educational Research and Improvement can provide these examples for your use.

Sharon P. Robinson
Assistant Secretary
Office of Educational Research and Improvement
U.S. Department of Education

TABLE OF CONTENTS

INTRODUCTION

Mathematics and science literacy are vital in today's world. To help students achieve them, significant changes are required in the ways that students are taught these subjects. Professional groups such as the National Council of Teachers of Mathematics, the National Science Teachers Association, the American Association for the Advancement of Science, and the National Research Council have provided guidance through standards describing what students should know and be able to do in mathematics and science. These standards require changes in the classroom.

How can teachers and schools begin to make the necessary changes? To provide help on a national level, the nation's ten Eisenhower Regional Consortia identified 117 promising practices for teaching science and mathematics which are described in this book. Of these, 67 have been presented in *Promising Practices in Mathematics and Science Education* (1994) and 50 appear in the present volume.

Information about all 117 programs can be found on a searchable database accessed via gopher on the Internet at *gopher.rbs.org*. From the main menu, look under "Mid-Atlantic Eisenhower Consortium for Math/Science Education," then "Other Internet Math/Science Education Resources (e.g., Databases)," and then "Promising Practices in Mathematics and Science Education." Explicit directions on how to search the database are an option on the main menu.

Selecting Promising Practices

This volume of promising practices in mathematics and science education provides an array of innovative ideas. The programs and practices described range from individual classroom activities to system-wide, multi-grade efforts. The practices emerged from a broad-based search, nomination, and review process.

The selection process involved four stages. During the first stage, each consortium solicited nominations from its region using a customized application form. The second stage involved evaluative reviews in each region by panels of mathematics and science educators. The criteria used to evaluate each program included innovativeness, support of national standards, effectiveness, and transferability. In the third stage, a national review was conducted by representatives from each of the ten regional consortiums to ensure consistency across the nation. Site visits were conducted in the fourth stage to confirm that the selected programs and practices were in reality as described in the nomination and review materials.

National Network of Eisenhower Mathematics and Science Regional Consortia and National Clearinghouse

The Office of Educational Research and Improvement's Eisenhower Federal Activities Program, formerly known as the Eisenhower National Program for Mathematics and Science Education, funds ten regional consortia and a national clearinghouse to assist educators and policymakers in the improvement of mathematics and science education.

The National Network of Eisenhower Regional Consortia promotes systemic education reform to increase the ability of all children to use mathematics and science as citizens, future workers, and scholars. The consortia are engaged in the dissemination of exemplary materials, teaching methods, and assessment resources and provide technical assistance to local, state, and regional efforts aimed at the improvement of mathematics and science education.

Collaboration among key players in each region provides policy and procedural guidance for each consortium. Resources are provided to support participation in consortium activities, especially for traditionally underserved and underrepresented populations. The consortia employ the Regional Educational Laboratories' national computer-telecommunications infrastructure to provide communication vehicles and research and development information for systemic improvement in mathematics and science education.

Access to K-12 mathematics and science educational materials is essential to systemic improvement. The Eisenhower National Clearinghouse provides K-12 teachers with a central source of information on such curriculum materials. The purpose of the Clearinghouse is to encourage the adoption and use of K-12 materials and programs that support national goals to improve teaching and learning in mathematics and science. The Clearinghouse accomplishes this task by creating and maintaining a comprehensive, multimedia collection of materials and programs that are distributed using both traditional formats and advanced computing and telecommunications technologies. For more information about the Eisenhower National Clearinghouse see page 155.

The Office of Educational Research and Improvement (OERI)

The U.S. Department of Education's Office of Educational Research and Improvement (OERI) currently funds the National Network of Eisenhower Regional Consortia and National Clearinghouse. OERI supports and conducts research on education, collects and analyzes education statistics, disseminates information, and supports improved library education and services. In general, mathematics and science are part of the broader OERI educational mission. The section starting on page 137 includes an annotated listing of mathematics and science programs that have been evaluated and proven effective by the U.S. Department of Education, as well as an explanation of how these programs are disseminated through OERI's National Diffusion Network (NDN).

National Network of Eisenhower Mathematics and Science Regional Consortia and National Clearinghouse

Eisenhower Math/Science Consortium at the Appalachia Educational Laboratory
P.O. Box 1348
Charleston, WV 25325
304-347-0400
(Region Served: Kentucky, Tennessee, Virginia, and West Virginia)

Far West Regional Consortium for Science and Mathematics
730 Harrison Street
San Francisco, CA 94107
415-241-2730
(Region Served: Arizona, California, Nevada, and Utah)

High Plains Consortium for Mathematics and Science
2550 S. Parker Road, Suite 500
Aurora, CO 80014
303-337-0990
(Region Served: Colorado, Kansas, Nebraska, Missouri, Wyoming, North Dakota, and South Dakota)

Midwest Consortium for Mathematics and Science Education
1900 Spring Road, Suite 300
Oak Brook, IL 60521
708-571-4700
(Region Served: Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin)

Eisenhower Regional Alliance for Mathematics and Science Education Reform
300 Brickstone Square, Suite 950
Andover, MA 01810
508-470-0098
or 235 Main Street
Montpelier, VT 05602
802-223-0463
(Region Served: Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, Puerto Rico, and the Virgin Islands)

Northwest Consortium for Mathematics and Science Education
101 S.W. Main Street, Suite 500
Portland, OR 97204
503-275-9594
(Region Served: Alaska, Idaho, Oregon, Montana, and Washington)

Pacific Mathematics and Science Regional Consortium
828 Fort Street Mall, Suite 500
Honolulu, HI 96813
808-533-6000
(Region Served: American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Hawaii, Republic of the Marshall Islands, and Republic of Palau)

Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education
Research for Better Schools
444 N. Third Street
Philadelphia, PA 19123
215-574-9300
(Region Served: Delaware, Maryland, New Jersey, Pennsylvania, and the District of Columbia)

SERVE Mathematics and Science Regional Consortium
345 S. Magnolia Drive, Suite D-23
Tallahassee, FL 32301
904-671-6033; 800-854-0476
(Region Served: Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina)

Southwest Consortium for the Improvement of Mathematics and Science Teaching
211 E. Seventh Street
Austin, TX 78701
512-476-6861
(Region Served: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas)

Eisenhower National Clearinghouse for Mathematics and Science Education
The Ohio State University
1929 Kenny Road
Columbus, OH 43210
614-292-7784

Eisenhower Federal Activities Program
Office of Educational Research and Improvement
U.S. Department of Education
555 New Jersey Avenue, NW
Washington, DC 20208-5572
202-219-2206

How to Use This Book

This collection of promising programs and practices in mathematics and science education provides an array of innovative ideas of interest to K-12 teachers and persons involved in teacher education. These ideas can be used as model programs and practices. The following list offers specific examples of how these programs and practices can be used.

- *Awareness of possibilities.* Increase the awareness of school board members and administrators about new ways of teaching mathematics and science education.
- *Awareness of specific local / regional programs.* Discover exciting activities at nearby schools.
- *Awareness of how other schools are coping with similar needs.* Learn how other schools deal with equity, environmental education, student motivation, etc.
- *Adaptation of ideas for use in your classroom.* Incorporate pollution testing, landscape planning, or imaginary space travel into your curriculum.
- *Adaptation of program / practice in your school (or district).* Get together with colleagues to plan a "Nitty Gritty" or "Environmental Education Water Study Program" of your own.
- *Network with contact persons listed in this book.* Talk to other teachers practicing similar approaches to teaching in their classrooms.
- *Staff development.* Get ideas for staff development activities that are meaningful and interesting.
- *Teacher education.* Examine how these programs and practices model the new facilitative method of teaching.
- *Grant writing.* Use the program information in grant writing, e.g., if you want a grant to implement a similar program, the evaluative information or contacting the developer may be useful.

This is only a sampling of ways this book can be used. We are interested in how you choose to use it. Please send comments to your regional consortium (listed on page vii).

In addition, if you know of any promising practices in mathematics and science education or have developed one yourself, please submit information about the practice to your regional consortium and the Eisenhower National Clearinghouse. Use the submission form on page 163.

How to Read the Program Descriptions

The practices in this book are arranged in alphabetical order. Use the indexes on pages 107 and 109 to search for programs by topic and grade level, and by name. Topics referenced include: elementary mathematics, secondary mathematics, elementary science, secondary science, environmental education, professional development, multidisciplinary, and technology-focused programs.

Each program/practice is presented in a two-page layout. The title of each practice appears prominently at the top of the left page, followed by the initiating location and a headline giving a synopsis of the program. Explanations of the other descriptors are presented for each practice; follow the numbers attached to each descriptor below and appropriately placed on the illustrated page opposite.

Explanation of left-hand page layout (refer to page xi)

1. **SUBJECT:** This descriptor gives the primary focus of the program. In this case, Elementary School Science is the focus.

2. **TARGET AUDIENCE:** This category delineates the grade levels where this program has been used successfully, the particular population for whom this program was designed, and who might be the likely users of this practice. However, this does not mean that others cannot use it successfully. A program may incorporate elements that specifically speak to minority groups or to women. In this example, the program has a focus on at-risk students, bilingual students, and culturally diverse classrooms.

3. **GENERAL DESCRIPTION:** This abstract conveys in simple terms what the program is about.

title of program

KIDS INVESTIGATING AND DISCOVERING SCIENCE

location → University of California, Irvine
School of Biological Science
Irvine, CA

one-line description

Three-week intensive summer program of science for at-risk elementary students with limited English proficiency

1

SUBJECT: Elementary School Science; Scientific Methodology; Technological Literacy

2

TARGET AUDIENCE: Grades K-8; At-Risk Students; Bilingual Students; Culturally Diverse Classrooms; Parents

GENERAL DESCRIPTION

3

The Kids Investigating and Discovering Science (KIDS) program began in 1990 at the University of California, Irvine (UCI) to establish a national model program of elementary science instruction for at-risk elementary students. The KIDS staff has developed and implemented innovative elementary curricula to teach valuable concepts in the physical, environmental, and biological sciences. Every year 120-150 elementary students with limited English proficiency are brought to UCI for a three-week intensive program of science instruction.

The KIDS program accomplishes the following tasks: (1) implements and disseminates an exemplary science program for grades K-8; (2) develops new physical, environmental, and biological science curricula; (3) institutes a national program of teacher training for new and current teachers that will enhance their preparation for science education; and (4) conducts a longitudinal study to evaluate methods that research institutions use to provide leadership in addressing the under-representation of minorities in the sciences.

A series of bilingual lesson plans has been developed to illustrate the importance of science and its relationship to the students' world. The lessons in physical, environmental, and biological science incorporate hands-on experimentation and have been designed to develop critical thinking and communication skills. The lessons are taught bilingually to encourage absorption of the materials, because younger students with limited English are reluctant to participate in the English-only classroom. An atmosphere of open communication between students and teachers helps provide the bilingual students with the confidence they need for effective learning. The program is further enhanced by after-school and weekend sessions with parents and students reviewing the curricula.

(Year Initiated: Summer 1989) ← year program was first used

38

Explanation of right-hand page layouts (refer to page xiii)

4. **GRADE LEVEL:** The graph located in the top right-hand corner of the page shows the grade levels for which the program/practice is best suited.

5. Descriptions found in this section indicate the types of instructional materials that are used, teaching strategies that have been incorporated, assessment tools that are part of the practice, and the intended outcomes. More detailed information on this area may be found in the general description at the bottom of the first page.

6. **EVALUATION/EVIDENCE OF EFFECTIVENESS:** This descriptor indicates evaluative information and/or evidence of how effective the practice is in the classroom (e.g., student engagement and interest, increased enrollment in higher level classes, percentage of program graduates that go onto college, student performance on standardized tests, informal surveys, pre and post evaluations).

7. **RESOURCES/MATERIALS NEEDED FOR IMPLEMENTATION:** This section delineates the types of resources and support necessary for implementation of this program as well as costs.

8. **CONTACT:** The name of the person who can provide information and answer questions about the program/practice appears here. Information may also be obtained from the regional Eisenhower consortium which submitted the particular program *(see SOURCE)*.

9. **SITE(S):** The name of the site or sites where this program has been instituted appears in this segment. This site has successfully implemented the program/ practice and may possibly serve as a demonstration site.

10. **SOURCE:** This descriptor indicates the Eisenhower regional consortium which submitted the entry.

4 grade level

Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Learning Centers (classroom); Manipulative Materials; Multilingual Materials; Parent Materials; Teacher Workshops; Apple Software; Macintosh Software; Measurement Tools; Models; Slides; Transparencies; Videodiscs; Videotapes	Computer Managed Instruction; Demonstrations; Discussion; Field Trips; Independent Study; Interdisciplinary Approach; Journal Keeping; Multimedia Instruction; Oral Reports; Problem Solving Approach; Small Groups; Visual Learning	Attitude Surveys; Informal Assessment; Interviews; Observation; Performance Assessment; Scoring Rubrics; Student Journals	Collecting and Recording Data; Communicating; Comparing; Conceptualizing; Critical Thinking; Hypothesizing; Interpreting Data; Observing; Science Process Skills; Scientific Literacy

5

Evaluation/Evidence of Effectiveness

6

Parent comments, pre- and post-test student [illegible]es, and teacher comments were used to evaluate program effectiveness. Students' attitude toward science changed greatly, especially with respect to women's access to science and an increased interest in choosing science, engineering, and mathematics careers. Students look forward to participating each summer. Teachers noted marked improvement in children's attitudes and willingness to actively participate in all class projects, especially science. Children responded positively to mentoring by teaching assistants. They were eager to share with their peers the knowledge and expertise developed during the summer program.

Resources/Materials needed for Implementation

7

The science curriculum changes every year as resource availability varies. It has included biology, biomedical science, and computer and physical sciences. Materials are selected from donated university resources and adapted for each level. Problem-solving experiences can be created on the computer or with relatively inexpensive materials. In some cases, kits can be purchased and shared. Standard school supplies are provided by the participating school. The human resources required to implement the program are: one research-oriented program director, one curriculum developer, two undergraduate student assistants, two K-12 bilingual instructors, and one administrative assistant. Other resources needed are transportation and lesson translation, if Spanish versions are not provided.

Support

Consultation services can be provided by the director, and brief answers can be provided by the director and curriculum developer over the phone. Teacher training is provided, but the requesting institution is expected to cover all transportation, lodging, and incidental expenses.

Cost

The estimated cost for equipment is $19,300.

8

Contact: Ms. Nydia Hernandez
Associate Director of KIDS
University of California, Irvine
2730 N. Flower
Santa Ana, CA 92706
(Mail Inquiries Only)

9

Site(s): Carver, Fremont, Hoover, Jackson, and Pio Pico Elementary schools, and Carr, Spurgeon, and Willard intermediate schools in the Santa Ana Unified School District; schools in Los Alamitos, Placentia, and Texas.

10

Source: Far West Regional Consortium for Science and Mathematics

Promising Practices in Mathematics and Science Education

1995

ACTIVITY-CENTERED ELEMENTARY SCIENCE (ACES)

Kentucky Science and Technology Council, Inc.
Lexington, KY

Program provides elementary teachers with materials, training, and support for conducting an activity-centered science program.

SUBJECT: Biological Sciences; Earth Science; Physical Sciences

TARGET AUDIENCE: Grade K-6 Teachers; Economically Disadvantaged Students; Female Students; Minority Students; Rural Students

GENERAL DESCRIPTION

The Activity-Centered Elementary Science (ACES) initiative is an instructional improvement project for grades K-6. ACES provides teachers with the materials, training, and ongoing support they need to implement and sustain an effective activity-centered science program. Based on research and experience in implementing educational programs, ACES addresses major barriers to the teaching of quality elementary science. The program's goals and instructional activities are consistent with the Kentucky Learning Goals and Learner Outcomes, as well as the emerging national science standards.

The major features of ACES include the following: (1) an activity-centered instructional focus with high quality, developmentally appropriate learning activities drawn from many existing exemplary resources, such as SCIIS, SAPA, and Project WILD; (2) a materials kit, constructed to project specifications by Delta Education, Inc. for each grade level in ACES; (3) an ongoing program of staff development activities, including initial and follow-up workshops and regularly televised live seminars which utilize experienced ACES teachers and teacher educators who share their experiences and expertise; and (4) mechanisms to provide support and technical assistance, including regional consultants for local trouble-shooting, opportunities to interact during the televised seminars, and a forum on a statewide electronic bulletin board.

A typical ACES "activity" is the study of cotyledons. The teachers' guide outlines learner outcomes addressed, science process skills used, and materials needed, most of which are provided in the kit. Students plant bean seeds and observe the development and growth of the plants with and without cotyledons attached. They measure, graph, and interpret their observations. Charts are provided for recording data. Optional activities are suggested for extended study.

(Year Initiated: 1990)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Guides; Manipulative Materials; Units of Study; Teacher Guides; Teacher Workshops; Kits	Brainstorming; Cooperative Learning; Demonstrations; Experiments; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Oral Reports; Thematic Approach	Alternative Assessment; Embedded Assessment; Holistic Evaluation; Portfolios; Scoring Rubrics	Problem Solving; Science Process Skills

Evaluation/Evidence of Effectiveness

Educational indicators to determine the effectiveness of the program include student data on understanding science concepts, attainment of science process skills, and attitudes toward science. Teacher indicators include feedback on specific modules and activities, perceptions of students, barriers to implementation, effectiveness of support systems, and evaluations of professional development activities. Results indicate ACES students performed significantly better in achievement and process skill attainment and had a more positive attitude toward science.

Resources/Materials needed for Implementation

Teachers implementing ACES attend a two-day orientation and two follow-up days during the school year. They also commit to participating in seven online televised seminars during the school year. Administrators attend at least one day of the orientation. Curriculum materials needed for replication are contained in the ACES curriculum guide.

Support

Live monthly telecasts, regional and local conferences, and networking meetings through KET-NET, an online electronic bulletin board.

Cost

Cost is $85/kit.

Contact: Karen Gregory
Manager, Education Programs
Kentucky Science and Technology Council, Inc.
167 West Main St.
Lexington, KY 40507
Telephone: 606-233-3502
Fax: 606-259-0986

Site(s): Currently ACES exists in over 350 sites across Kentucky, including: Model Laboratory School, Richmond, KY; and Clark Elementary School, Paducah, KY

Source: Eisenhower Math/Science Consortium at the Appalachia Educational Laboratory

BECOMING SUCCESSFUL PROBLEM SOLVERS

HRM Video
Pleasantville, NY

Video series promotes mathematical problem solving in grades 4-9.

SUBJECT: Mathematical Concepts; Mathematical Applications

TARGET AUDIENCE: Grades 4-9; Culturally Diverse Classrooms

GENERAL DESCRIPTION

Becoming Successful Problem Solvers is a video series designed to promote mathematical problem solving in grades 4-9. The video and accompanying print materials can serve as instructional materials designed to teach problem solving and as assessment tools to help teachers better understand students' beliefs and attitudes concerning mathematics.

Each video episode is 15 minutes long and shows a pair of scripted child actors engaged in an effort to solve an interesting, real-life problem. The series is tied to the NCTM standards in terms of mathematical content and the standards for communication, connections, reasoning, and problem solving. The series format is unusual.

First, each episode is a "cliffhanger"; the problem is left unsolved. After showing a tape, teachers give students copies of an open-ended question based on the video. The question can be worked on individually or in small groups. Second, each episode consists of two parts; questions for students are integrated, on screen, into each part. Most of these questions focus on students' beliefs and attitudes about mathematics and problem solving. Embedding questions directly into the videotape helps assures that students are actively engaged with and thinking about the problem situation. Third, there is sufficient time within a single class period for teachers to manage class discussions of the problem situation. Typical questions might include the following: (1) Is there only one correct way to solve the problem? (2) Can the problem have more than one answer? (3) Is an estimate an acceptable alternative to an exact numerical answer? (4) Will I ever need to solve problems of this type?

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Assessment Materials; Enrichment Materials; Resource Units; Supplementary Materials; Teacher Guides; Videotapes	Cooperative Learning; Discussion; Multimedia Instruction; Problem Solving Approach; Visual Learning	Alternative Assessment; Attitude Surveys; Embedded Assessment; Informal Assessment; Performance Assessment	Communicating; Logical Thinking; Mathematical Literacy; Metacognition; Problem Solving; Thinking Skills; Visualizing

Evaluation/Evidence of Effectiveness

A carefully designed study of the first ten episodes in the series was conducted. Data collected from teachers included their opinions of each episode and aspects of the series as a whole. Data collected from students included: standardized vocabulary tests, an independent math test consisting of two non-routine mathematics problems, responses to the instruments for each episode used in class, and the responses to the open-ended questions used as the final or culminating episode in each classroom. Twenty-eight pairs of matched classrooms were used with random assignment of classroom to treatment. Experimental classes used six episodes; comparison classes used only one. Students in the experimental group had significantly fewer misconceptions about problem solving than the comparison classes and more positive beliefs about communication, reasoning, and connections. Teachers in the experimental classrooms expressed a high degree of enthusiasm about the series. For example, all teachers reported the materials were easy to use, and 90% agreed that the series "helped many students to see how mathematics is used in the real world."

Resources/Materials needed for Implementation

Becoming Successful Problem Solvers is available in three sets of four episodes each (designated Set 1, Set 2, and Set 3). The introduction describes how to use the series and provides specific information about leading class discussions and working on the open-ended problem. In addition, HRM Video has produced a 15-minute video that provides an overview of the series and how it is used in the classroom. Some episodes call for a minimal amount of additional material, such as scissors, as explained in the Teacher's Resource Book provided in each set. It is useful, but not essential for a group of teachers in a school to discuss the series as a training exercise.

Support

The developers would be pleased to answer questions that may arise, but there are no formal mechanisms (newsletters, 800 number, etc.) for teacher support. However, the distributor, HRM Video, does provide the materials for a free 30-day examination without the need of purchase order or other district approval. Any teacher interested can try the materials free of charge.

Cost

Costs include: $175 per set of videos; Teacher's Resource Book provided free with each set shipped by HRM.

Contact: Customer Service
HRM Video
175 Tompkins Ave.
Pleasantville, NY 10570
Telephone: 800-431-2050
Fax: 914-747-1744

Site(s): Trials have taken place in a total of six districts; three on Long Island, two in Maryland, and one in Virginia.More than 500 schools nationwide have purchased sets.

Source: Far West Regional Consortium for Science and Mathematics

BIOLOGY:

AS SCIENTIFIC INQUIRY

Sammanish High School
Bellevue, WA

Lab-centered high school program teaches biology through lab investigations and problem solving activities.

SUBJECT: Biology; Laboratory Experiments; Ecology; Physiology; Plants (botany); Heredity; Evolution

TARGET AUDIENCE: Grades 9-12; All Students

GENERAL DESCRIPTION

Biology: As Scientific Inquiry (B:ASI) is a unique year-long lab-centered high school program consisting of eight units that contain both text and lab activities. The lab investigations and other problem solving activities are the heart of the curriculum and have been developed to create a stimulating learning adventure.

Problem-solving activities are integrated throughout every unit. Students master the art of problem identification and hypothesis formation. They design and conduct original controlled experiments, as well as organize and interpret data. Students can have experiences very similar to those of the research scientist and develop valuable problem-solving skills applicable to a wide variety of situations.

The curriculum also stresses mastery of important biological concepts, is designed for all ability levels, and contains interdisciplinary connections where appropriate. Through the selective use of enrichment, the units can be used by students of all abilities. Topics are introduced with lab experiences and sequenced so they progress from the familiar to the abstract. The units are: (Unit I) Introduction to Biology, (Unit II) Cells, (Unit III) Animals and Human Processes, (Unit IV) Plant Processes, (Unit V) Reproduction and Development, (Unit VI) Genetics, (Unit VII) Classification and Evolution, and (Unit VIII) Interdisciplinary Ecology.

(Year Initiated: 1984)

grade level [Pre-k K 2 4 6 8 10 12 +]

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Laboratory Manuals; Manipulative Materials; Textbooks; Teacher Workshops; Books; Diagrams; Macintosh Software	Cooperative Learning; Discovery Learning; Experiments; Hands-on Learning; Interdisciplinary Approach; Object Manipulation; Problem Solving Approach; Small Groups	Answer Keys; Criterion Referenced Tests; Embedded Assessment; Mastery Tests; Performance Assessment	Analyzing; Collecting and Recording Data; Conceptualizing; Experimenting; Hypothesizing; Interpreting Data; Predicting; Problem Solving; Reasoning; Science Process Skills

Evaluation/Evidence of Effectiveness

Test data shows that students using Biology: As Scientific Inquiry perform better than those using traditional curricula. For six of the 12 years that B:ASI has been in Bellevue Public Schools, 14 teachers from four high schools administered a year end test to all of their students. Six of the 14 teachers used B:ASI (experimental group) and the remaining teachers used other biology curricula (control group). A graph was constructed showing a composite of yearly data based on student scores for nine objective categories including applying scientific problem solving skills. The data show a dramatic difference in student performance for all objectives. Attendance has been good, and parent feedback is positive. Students' letters and informal conversations indicate a very positive attitude with a high rate of students choosing careers in science. Student assessment instruments show good progress and subject mastery.

Resources/Materials needed for Implementation

No special staff training is essential for replication. Many schools use the program without trained teachers; however, a one to four hour workshop is helpful. To offer most lab activities in the eight units, a wide variety of materials, cultures, and consumables are required. These materials are affordable, even for schools with below average supply budgets. A combined text/lab manual, Biology: As Scientific Inquiry (850 pages), is required. All eight units are bound separately and can be purchased individually or as a set. Teachers' editions and "Teacher's Lab Preparation Information" are also available, as are optional computer programs that can be purchased to supplement specific units.

Support

Users can call Ron Thompson at Connecting Point for support and assistance.

Cost

The cost is approximately $85 per class, per year for materials. There is no charge for training, if the site is within 50 miles of Seattle; expenses are required for longer distances. The text/lab manual is $29.90 for all eight units, and prices for computer programs are $12-$25.

Contact: Ron Thompson
Connecting Point
6 Lindley Road
Mercer Is., WA 98040
Phone/Fax: 206-230-8360

Site(s): Three high schools in Bellevue, WA; seven other western Washington school districts; Issaquah High School, Issaquah, WA; Willmar Senior High School, Willmar, MN; and Hughson Union High School, Hughson, CA; and districts in British Columbia, Oregon, California, Minnesota, Missouri, Illinois, Michigan, Maryland, and Massachusetts.

Source: Northwest Consortium for Mathematics and Science Teaching

College Preparatory Mathematics: Change from Within

University of California
CRESS Center
Davis, CA

Mathematics curriculum for high school students replaces standard college-preparatory math with problem-based, integrated curriculum.

Subject: Secondary School Mathematics; Algebra; Geometry; Mathematical Applications; Proof (mathematics); Ratios (mathematics); Trigonometry

Target Audience: Grades 9-12; Culturally Diverse Classrooms; Gifted/Honors Students

General Description

College Preparatory Mathematics: Change from Within (CPM) is a high school mathematics curriculum that replaces the current, standard college-preparatory math program with a rich problem-based, integrated curriculum. The program strives to enable more students to succeed—especially those from groups historically underrepresented in mathematics-based fields. Teachers working with university mathematicians developed Math 1, Math 2, and Math 3 as replacements for the traditional Algebra 1, Geometry, and Algebra 2 courses. They are designed so that teachers can use them one course at a time, and students can benefit from CPM courses even if their next math course is a traditional one.

The courses are integrated to the extent that much more geometry is used in Math 1 and more algebra is developed in Math 2. Graphing is introduced with data organization at the outset and is the backbone of all three courses. In a sense, the courses are better integrated than some topic-hopping sequences. For example, in Math 1 (Algebra 1), graphing, geometry, probability, and data organization are used to support the learning of algebraic concepts. Materials are designed to engage students in problem solving, mathematical reasoning, cooperative group work, and developing use of mathematical language and understanding through discussion. Therefore, use of manipulatives and calculators and work on application-based problems are standard procedure.

(Year Initiated: 1989)

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Calculator-Active Materials; Group Projects; Integrated Materials; Textbooks; Training Programs; Calculators; Graphing Calculators	Brainstorming; Cooperative Learning; Discussion; Hands-on Learning; Object Manipulation; Problem Solving Approach; Small Groups; Writing Across the Curriculum	Group Assessment; Informal Assessment; Portfolios; Problem Sets; Tests	Abstract Reasoning; Communicating; Graphing (mathematics); Hypothesizing; Problem Solving; Proportional Reasoning; Reasoning; Recognizing Patterns; Spatial Ability; Using Equations

Evaluation/Evidence of Effectiveness

A year end assessment composed of two problems is given to each student. The problems are holistically scored for schools that have both traditional and CPM classes. CPM students from a wide variety of ethnic and linguistic backgrounds scored significantly higher than their peers enrolled in traditional high school mathematics courses. The number of teachers involved each year has been increasing. The project has grown from 30 teachers in 1989 to 1500 teachers (from 500 schools in California) by the start of the 1993-94 school year.

Resources/Materials needed for Implementation

A minimum of seven full workshop days is required for the first year a teacher uses each of the CPM courses. These consist of two days of introductory workshops before school begins and five days of meetings during the school year that provide the opportunity for discussion, hands-on previews of upcoming units, and alternative approaches to assessment. One CPM student text per student and one CPM teacher text per teacher are needed. The student text consists of two 8 1/2" x 11" paper-bound volumes that can be kept in a student's binder. It is composed entirely of problems ranging from exercises to investigations. The teacher text explains how to use the problems and includes an assessment section and a resource section. A short video, "The Burning Candle," is also needed. It can be obtained from the CPM Educational Program in Sacramento.

Support

A newsletter is distributed which reports good ideas shared during meetings. It provides encouragement during adjustment periods, and tells about new developments in assessment. A three-day leadership conference is available for those teachers interested in leading the following year's meetings. Currently, six alternative assessment, week-long workshops are being supported in three locations during the summer. Both the leadership and assessment workshops include a stipend for the participants.

Cost

Costs include: Math 1, Student Version, $10; Math 1, Teacher Version, $25; Math 2, Student Version, $15; Math 2, Teacher Version, $35; teacher workshops - $180-$250, per teacher, per year; video - $10. Other items used are common objects that cost under $100 the first time a teacher gathers them for a course.

Contact: Judith Kysh, Co-Director
University of California, CRESS Center
Davis, CA 95616-8729
Telephone: 916-752-8393
Fax: 916-752-6135
Internet Address: jmkysh@ucdavis.edu

Site(s): The program is being used in more than 500 sites in California, for example: Center High School, Sacramento, CA; West High School; Torrance, CA; San Bernardino High School, San Bernardino, CA.

Source: Far West Regional Consortium for Science and Mathematics

THE COMMONWEALTH EXCELLENCE IN SCIENCE TEACHING ALLIANCE (CESTA)

The Franklin Institute
Philadelphia, PA

Residential summer leadership institute for teachers seeks to improve teaching of hands-on science.

SUBJECT: Elementary School Science; Biological Sciences; Earth Science; Physical Sciences; Scientific Concepts; Technology

TARGET AUDIENCE: Grade K-9 Educators; Policy Makers; All Students

GENERAL DESCRIPTION

The Commonwealth Excellence in Science Teaching Alliance (CESTA) Project seeks to improve science education in grades K-9 by helping teachers improve their ability to teach hands-on inquiry-based science. Participating teachers attend an annual two-week residential Summer Leadership Institute where they receive instruction in hands-on activities, classroom and materials management, alternative student assessment, how to conduct workshops, and other leadership skills. Networking and collaboration resulting from the course provide teacher support which helps to achieve the CESTA goal of improving science education.

Each participating school district signs a commitment to support their enrolled teams (two teachers and one administrator each) for three years as they carry out an Action Plan to teach other teachers. The CESTA project coordinator conducts follow-up visits with the teams, attends their workshops, makes school visits, maintains the network, and facilitates the flow of information among teams. The three most important features contributing to the success of the project are the school district commitment to support their teams, the Action Plan required of each team, and follow-up visits made by the project coordinator. The project works best as a statewide initiative, forming a network throughout the state, and overseen and supported by regional committees; however, it can be adapted to smaller configurations.

(Year Initiated: 1990)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Activity Books; Assessment Materials; Enrichment Materials; Group Projects; Individual Projects; Individualized Materials; Integrated Materials; Manipulative Materials; Supplementary Materials; Teacher-Developed Materials; Teacher Workshops; Charts; Diagrams; Kits; Measurement Tools	Brainstorming; Cooperative Learning; Demonstrations; Discovery Learning; Discussion; Experiments; Hands-on Learning; Informal Education; Interdisciplinary Approach; Problem Solving Approach; Small Groups	Alternative Assessment; Concept Maps; Group Assessment; Observation; Performance Assessment; Portfolios; Student Journals; Word Problems	Abstract Reasoning; Communicating; Conceptualizing; Decision Making; Experimenting; Interpreting Data; Thinking Skills; Problem Solving; Reasoning; Scientific Literacy

Evaluation/Evidence of Effectiveness

In Pennsylvania, pilot site of the project, there are now 145 CESTA teachers working in over 60 school districts throughout the state. Through June 1993, hands-on skills from teacher-developed action plans had been taught to more than 6,000 other teachers.

Resources/Materials needed for Implementation

The primary needs are an exciting and inspirational teacher who understands inquiry-based, hands-on science and regular on-site follow-up and support for the teachers. Materials used are simple hands-on materials available in grocery and department stores.

Support

Support available from Franklin Institute, which is to become an Internet node providing Satellite Distance Learning.

Cost

Costs vary with scope and site. A two-week residential institute for 24 participants typically costs a total of $1500.

Contact: Dr. Kenneth E. Schroder
CESTA Director
The Franklin Institute
20th and the Parkway
Philadelphia, PA 19103
Telephone: 215-448-1347
Fax: 215-448-1235

Site(s): CESTA is used in approximately 65 sites in Pennsylvania and is available for export to other states.

Source: Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education

COMMONWEALTH PARTNERSHIP BIOLOGY INITIATIVE FOR SECONDARY SCHOOL TEACHERS

The Commonwealth Partnership
Lancaster, PA

Residential summer institute for biology teachers focuses on molecular and cell biology.

SUBJECT: Biochemistry; Genetics;Microbiology; Molecular Structure; Secondary School Science

TARGET AUDIENCE: Grade 9-12 Biology Teachers; All Students

GENERAL DESCRIPTION

The goal of the Biology Initiative is to improve student interest and achievement in science, and through collaboration, to create and nurture a community of educators dedicated to continuing professional development in science education. Teachers begin the program by attending a three-week residential institute held on a college campus. Participants are nominated by their school principals and recognized as Commonwealth Teaching Fellows.

The course curriculum focuses on molecular and cell biology. During the following two years, Fellows incorporate institute materials into their courses, conduct outreach activities for other biology teachers, and create local professional development programs to sustain the process of collaboration and curricular improvement.

The Biology Initiative was the fourth collaborative program for secondary school teachers and the first program in the sciences sponsored by the Commonwealth Partnership. It was built on the Partnership's previous six years of experience in designing and conducting programs to strengthen instruction in the humanities. The Biology Initiative was planned as the first of a larger series of programs for science teachers over the next ten years.

(Year Initiated: 1990)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Guides; Manipulative Materials; Program Descriptions; Teacher Professional Development Materials; Teacher Workshops; Books	Brainstorming; Cooperative Learning; Discussion; Experiments; Field Trips; Hands-on Learning; Individual Instruction; Issues Oriented Science; Lecturing; Small Groups; Thematic Approach	Attitude Surveys; Surveys	Collecting and Recording Data; Communicating; Controlling and Manipulating Data; Critical Thinking; Divergent Thinking; Experimenting; Interpreting Data; Science Process Skills

Evaluation/Evidence of Effectiveness

Evaluation techniques included independent evaluators conducting interviews and comprehensive studies, attitude surveys, and panel discussions. The institutes were rated highly.

Resources/Materials needed for Implementation

If a college or university were to host a program like the Biology Initiative, it would need the facilities and personnel to house a residential institute and support the program's three-year administration. In addition, faculty members are needed to serve as program advisors, counselors, and administrators for the program participants. A program director and support staff are also necessary for overseeing, coordinating, and managing the logistics of program implementation.

Support

Teacher enhancement and support for ongoing professional development are integral to the Biology Initiative. Teachers and faculty consult with each other by conducting regular institute reunions, contributing to the tri-annual newsletter, taking advantage of computer networks, and participating in regional professional associations. The project office also coordinated the development and distribution of regional resource and networking lists for our Teaching Fellows.

Cost

Total cost of running a three-year program like the Biology Initiative, including residential housing fees, salaries for faculty and project office personnel, teacher stipends, and material costs, is roughly $250,000 per site. A nonresidential institute would reduce this cost substantially.

Contact: Ellen R. Trout, Director
The Commonwealth Partnership
P.O. Box 3003
Lancaster, PA 17604
Telephone: 717-291-4304
Fax: 717-291-4381

Site(s): The program has been successfully replicated at five Commonwealth Partnership Campuses in Pennsylvania: Allegheny College, Meadville, PA; Carnegie Mellon University, Pittsburgh, PA; Gettysburg College, Gettysburg, PA; Haverford College, Haverford, PA; and Lehigh University, Bethlehem, PA.

Source: Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education

CONNECTING MATHEMATICS AND PHYSICAL SCIENCE

Conway Junior High School
Conway, AR

Integrated study of algebra and physical science promotes interest and achievement in ninth-grade mathematics and science.

SUBJECT: Mathematical Concepts; Scientific Concepts; Mathematical Applications; Science Experiments; Technology; Algebra; Chemistry

TARGET AUDIENCE: Grade 9; Culturally Diverse Classrooms; Suburban Students

GENERAL DESCRIPTION

Connecting Mathematics and Physical Science provides an integrated approach to the study of algebra and physical science for 9th-grade students. The class is composed of heterogeneously grouped students enrolled in back-to-back algebra and physical science classes. This allows for extended activities and explorations that integrate the skills and concepts of both subjects. The classes meet jointly once or twice a week. Work on specific skills in each subject is done on the other days.

Units have been developed which integrate algebra and physical science with the use of technology tools for the analysis of physical science principles. The course stresses modeling real data, integrated use of computers and graphing calculators, hands-on experiments, and writing. Outside resources are used extensively.

(Year Initiated: 1993)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Calculator-Active Materials; Course Descriptions; Group Projects; Integrated Materials; Laboratory Manuals; Computer Software; Databases; Graphing Calculators; Laserdiscs; Measurement Tools; Models; Probeware; Programmable Calculators	Cooperative Learning; Discovery Learning; Experiments; Field Trips; Hands-on Learning; Interdisciplinary Approach; Problem Solving Approach; Small Groups; Thematic Approach; Visual Learning	Performance Assessment; Comparison of Student Work	Analyzing; Collecting and Recording Data; Communicating; Graphing (mathematics); Interpreting Data; Problem Solving; Reasoning; Science Process Skills; Scientific Literacy; Thinking Skills

Evaluation/Evidence of Effectiveness

The effectiveness of this program has been established thus far through the observations of the program teachers and the evidence of academic progress made by the students. Parents have reported a marked improvement in their children's understanding of scientific principles and attitude toward mathematics and science. Students and parents have indicated their desire to have a similar opportunity open to students in the coming years.

The following measures were used to assess the success of the program: comparisons of student work, performance assessment, and self-direction of students. Results indicated that students participating in the integrated approach consistently performed at or above the level of other students. Student projects and products reflect an application of their mathematics and science knowledge. Teachers have observed a higher student interest in the integrated class. Students are self-directed and their cooperative learning skills exceed those of the other students at their grade level.

Resources/Materials needed for Implementation

The following are needed for replication: standard laboratory materials used in a physical science class; integrated lessons and student problems; and two experienced and knowledgeable teachers with time for planning, coordinating, and implementing an integrated program for algebra and physical science students.

Support

Program developers are available for consultation and support for sites interested in replicating this program. They will return calls and respond to requests for materials describing how they developed the resources needed to implement the program. A collection of sample student problems is available. Dr. Linda Griffith, University of Central Arkansas, is serving as a consultant to this program and is also willing to provide support in replication. Reach her by phone at 501-450-5663; by mail at University of Central Arkansas, 201 Donaghey Ave., P.O. Box 4912, Conway, AR 72035.

Cost

Approximate cost for equipment is $4,000. Costs for laboratory materials and staff will vary by site.

Contact: Linda Glover, Mathematics Teacher
Jerry Mimms, Physical Science Teacher
Conway Junior High School
1815 Prince Street
Conway, AR 72032
Telephone: 501-450-4860

Site(s): Carl Stuart Middle School, Conway, AR.

Source: Southwest Consortium for the Improvement of Mathematics and Science Teaching

EARTH CAMP

Scott County Schools
Gate City, VA

Week-long science camp provides secondary students with hands-on experience in a variety of scientific disciplines.

SUBJECT: Astronomy; Biological Sciences; Chemistry; Mathematics Skills; Statistics; Technical Mathematics; Technological Literacy

TARGET AUDIENCE: Grades 9-12; Rural Students

GENERAL DESCRIPTION

Earth Camp provides an intensive, week-long, integrated science experience set in the ecologically unique Appalachian Mountains of Scott County, Virginia. The camp is operated with the support and involvement of numerous local volunteers, agencies, park personnel, and scientists. It provides interested students with the opportunity to learn about and become actively involved in a variety of scientific disciplines such as earth and life sciences, chemistry, ecology, astronomy, and geology.

Students working with local experts and practicing scientists conduct their own research, analyze data, draw conclusions, and publish their findings. They learn first hand about scientific methods and ecological issues by engaging in such projects as conducting observable and microscopic stream life studies, doing water quality analysis, taking geological field trips to natural caves in the area, working with mining reclamation specialists at the Powell River Project, and conducting endangered mussel bed surveys with the Nature Conservancy. Other activities such as orienteering, hiking, habitat restoration, and star gazing with a local astronomy club make for a full week of learning.

(Year Initiated: 1990)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Group Projects; Science Projects; Simulations; Student Projects; Realia	Cooperative Learning; Discovery Learning; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Problem Solving Approach; Self-Directed Groups	Alternative Assessment; Informal Assessment; Interviews; Student Journals	Communicating; Creative Thinking; Hypothesizing; Interpreting Data; Science Process Skills; Visualizing

Evaluation/Evidence of Effectiveness

Evaluation methods include student and teacher evaluation using a questionnaire and interview and quality of journal responses. The program was found to involve all participants actively in the learning experience.

Resources/Materials needed for Implementation

Human resources needed for replication of the program include local experts on the area, one counselor for every six to eight students, and a director. Materials needed are water quality analysis equipment such as screens, vials, slides, droppers, and chemicals; field books for reference; microscopes; flashlights; and helmets. Word processing capability is suggested.

Contact: Danny Dixon
Director of Instruction
Scott County Schools
261 E. Jackson St.
Gate City, VA 24251
Telephone: 703-386-6118
Fax: 703-386-2684

Site(s): Scott County Schools, Gate City, VA

Source: Eisenhower Math/Science Consortium at the Appalachia Educational Laboratory

ENVIRONMENTAL AWARENESS

Bridgeport Elementary School
Tualatin, OR

Ecosystems developed on school site provide students and community with hands-on environmental experiences.

SUBJECT: Conservation Education; Plants (botany); Science and Society; Water; Earth Science; Mathematical Applications

TARGET AUDIENCE: Grades 1-6; Community; All Students

GENERAL DESCRIPTION

The goal of Environmental Awareness is to educate the community about the relationship among people, their activities, and the environment. This is accomplished by providing a natural setting in which a variety of environmental experiences can occur.

Bridgeport Elementary School has developed a significant portion of school property into an outdoor environmental education laboratory. The site includes wetland/riparian and meadow ecosystems. The project provides hands-on learning experiences for Bridgeport students and the local community. When fully established, the laboratory will be self-sustaining and serve the entire student body as the central component of the school's environmental education curriculum.

Teachers will benefit from having a readily accessible site in which to conduct environmental education activities such as collecting animal specimens, monitoring plant growth, and collecting soil samples. Students' families and members of the community will benefit from the lab through after school and evening science activities.

(Year Initiated: 1991)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Books; Calculators; CD-ROMs; Charts; Computer Software; Databases; Diagrams; Encyclopedias	Cooperative Learning; Discovery Learning; Hands-on Learning; Independent Study; Individual Instruction; Interdisciplinary Approach; Journal Keeping; Self-Directed Groups; Small Groups; Thematic Approach; Webbing	Alternative Assessment; Attitude Surveys; Field Tests; Informal Assessment; Interviews; Observation; Performance Assessment; Portfolios; Student Journals; Word Problems	Analyzing; Collecting and Recording Data; Communicating; Decision Making; Environmental Awareness; Inferring; Interpreting Data; Measuring; Observing; Science Process Skills

Evaluation/Evidence of Effectiveness

The following educational indicators were used to determine the success of the program: (1) student attitudes toward the environment; (2) student awareness of current environmental issues; (3) student participation in the program; (4) parent comments; and (5) community involvement in the program. Data gathered were positive, showing student attitudes toward school and community environments have improved. Students expressed concern about taking care of the environment. One hundred percent of approximately 100 students who were asked to develop the lab site volunteered their free time to help. Parents have commented that their children are much more aware of the environmental issues facing the community. Approximately 200 people attended the evening family program held at a nearby wetland, demonstrating community interest in the project.

Resources/Materials needed for Implementation

A landscape architect or someone familiar with native plants is required to plan the site. It would be helpful to have some training in naturescaping. Two kinds of materials are needed to replicate the program: first, a resource that describes and lists native plants for the replicator's area (Environmental Awareness uses "Naturescaping" published by the Oregon Department of Fish and Wildlife); and second, a source for native plants.

Support

Students will prepare an educational video that will be helpful for program replication.

Cost

The cost of plants ranges from $0 to $1,000 dollars depending on the size of the project and how many plants can be obtained through sources such as the Forest Service. "Naturescaping" is $11, and the fee for a landscape architect varies. Environmental Awareness' architect donated his services.

Contact: Mike Tomlinson, Teacher
Bridgeport Elementary School
5505 S.W. Borland Road
Tualatin, OR 97062
Telephone: 503-684-2332
Fax: 503-684-2328

Site(s): Several other school naturescape sites are reported, but unconfirmed.

Source: Northwest Consortium for Mathematics and Science Teaching

ENVIRONMENTAL EDUCATION

Hawai'i Nature Center
Honolulu, HI

Nature center school programs for K-6 students teach environmental literacy through hands-on field experiences.

SUBJECT: Environmental Education; Biological Sciences; Earth Science; Ecology; Science & Society

TARGET AUDIENCE: Grade PreK-6 Educators; All Students

GENERAL DESCRIPTION

The Hawai'i Nature Center's school programs teach children about the outdoors in the outdoors. Innovative, hands-on field experiences are combined with classroom curricula and take-home projects to build solid foundations of environmental literacy. Through the gentlest of introductions to nature at the pre-school level to the challenges of a sixth grade native forest overnight program, the outdoor education programs motivate students and inspire positive attitudes and values towards nature.

The school programs were developed thematically to integrate with the State Department of Education's scope and sequence for environmental studies and science. They integrate connections among different scientific concepts and disciplines. The project materials are developed around major environmental themes, including change, interdependence, and cycles. The disciplines of science, social studies, language arts, math, and art are woven throughout each theme.

While the emphasis is on science, the interdisciplinary nature of the materials allows teachers and students to make connections among biological and earth sciences; to investigate ideas from ecological, cultural, and community perspectives; and to use basic skills from various disciplines as discovery tools. Each grade level focuses on a specific environmental concept and addresses a different Hawaiian ecosystem. Stewardship and environmental responsibility are emphasized at every level, and specific skills and knowledge development are included as appropriate. Every school program includes three to four hours of field activities, and every activity is innovative, unique, and designed to use a minimum of materials while encouraging maximum outdoor adventure. For example, first graders begin a habitat lesson in a tree house where they review their own habitat requirements before venturing out into the forest on a habitat hunt. In addition, each student is given a project to complete at home in an effort to extend the day's impact and encourage students to share their experiences and discoveries with their parents.

During the last 12 years, more than 275,000 children have explored the outdoors at the Hawai'i Nature Center. The programs have expanded 200% since 1986. The primary resources that make the innovative programs possible include a team of over 500 valuable volunteers, a dedicated volunteer Board of Directors, committed and creative staff, an involved membership, and the creative partnerships developed with government, local, and national foundations and corporations.

(Year Initiated: 1981)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Games; Manipulative Materials; Parent Materials; Reference Materials; Teaching Units; Realia	Cooperative Learning; Field Trips; Hands-on Learning; Interdisciplinary Approach; Multicultural Approach; Problem Solving Approach; Thematic Approach	Alternative Assessment; Informal Assessment; Performance Assessment	Collecting and Recording Data; Decision Making; Environmental Awareness; Experimenting; Interpreting Data; Observing; Problem Solving; Reasoning; Science Process Skills; Thinking Skills

Evaluation/Evidence of Effectiveness

Methods include: independent written teacher evaluations, student letters and pictures, and enrollment. Evaluations have all been positive, and teachers and students comment that the field trips are the best they have ever been on. Program enrollment is filled the first day of reservations with thousands of students currently on the waiting list.

Resources/Materials needed for Implementation

Talented outdoor education professionals are a key component of the programs. These individuals have an inherent love for the natural world and are able to translate their enthusiasm for even the most elemental forms of life. The limited paid staff is supplemented by volunteer teachers who are given preparatory inservice training. Teacher packets are essential for the program and include an outline of the day's events, a list of reminders, pre- and post-visit activity suggestions, as well as actual classroom curricula, a sample letter for parents, scientific background information, and an annotated list of references. Each teacher packet is designed for a specific program at a specific site. They are available only to teachers planning field trips to the Nature Center and are free of charge. Someone duplicating the programs elsewhere would have to create their own Teacher Packets.

Support

Local educators' needs are accommodated by sharing information, ideas, supplies, and expertise. National or international consultation is provided for a minimal fee. At present, those interested in the programs are welcome to observe, participate in teacher workshops, or join our organization and receive regular newsletters highlighting activities. In addition, a "how to" book designed to capture the Center's unique style of outdoor adventure is being written. It will include the steps involved in developing successful, hands-on environmental educational programs.

Cost

Primary expenses are staff time to develop the programs, sites and packets. Current annual program operating budget is $850,000, serving 57,000 people on three islands.

Contact: Diana King
Education Director
Hawaii Nature Center
2131 Makiki Heights Dr.
Honolulu, HI 96822
Telephone: 808-955-0100
Fax: 808-955-0116

Site(s): Island of O'ahu at the Makiki site, United States Fish and Wildlife Service Wildlife Refuge, on the Island of Maui in Iao Valley, various sites on the Island of Molokai.

Source: Pacific Mathematics and Science Regional Consortium

EXPLORING BIOLOGY

Moorehead State University
Biology Department
Moorehead, MN

Summer biology workshops that improve teachers' content knowledge, increase K-6 science skills.

SUBJECT: Biology; Environmental Education; General Science

TARGET AUDIENCE: Grade K-6 Teachers; Bilingual Students; Hispanic American Students; Minority Students; Native American Students; Rural Students

GENERAL DESCRIPTION

Exploring Biology is a set of summer biology workshops for elementary teachers developed by Moorehead State University. The goal of the program is to strengthen the content knowledge, teaching skills, and general science background of elementary teachers through inservice workshops and to develop science process and science thinking skills. The objective of this enhanced background and preparation is to increase teacher confidence and lead to better elementary science instruction. The workshops target teachers expected to have maximum impact on Native American and Hispanic students, and portions of these workshops have been adapted for teachers on the White Earth Reservation and the Minnesota Northern Region Summer Migrant School. The ultimate goal of the program is to increase student proficiency and interest in science.

Moorhead offers two week, four quarter-credit biology workshops. Topics include plants in the classroom, ecology and environmental science, animals and animal behavior, and human biology. The workshops feature hands-on experience with inexpensive materials in an inquiry setting. Emphasis is on computer applications and process skills including observing, formulating and testing hypotheses, data collection and analysis, and drawing conclusions. Participating teachers present an inservice activity for teachers in their respective schools. The workshop format encourages participant-generated observations, questions, and hypothesis formulation in a cooperative learning setting. Participants are guided in designing experiments to answer their questions. Teachers are encouraged to assist students in making observations or designing experiments to answer their questions rather than giving them answers.

In addition, some of the latest innovative materials such as the Wisconsin Fast Plants and Bottle Biology projects are introduced. Use of a computer for data collection, storage (spreadsheets), and graphics is integrated throughout the workshop. To maximize teacher implementation of workshop ideas and activities in classrooms, teachers are given background information in the content area as well as written materials which will assist in implementation of science investigations and activities.

Plans are to rotate through the different topics described above on a four-year cycle and to present these workshops to other regions in the state. In 1993 approximately 350 Hispanic summer migrant school students participated in science activities as a result of these workshops.

(Year Initiated: 1989)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Units of Study; Workshops; Supplementary Materials; Teacher Background Materials; Teacher Workshops; Measurement Tools	Cooperative Learning; Discovery Learning; Experiments; Hands-on Learning; Problem Solving Approach	Attitude Surveys; Observation; Performance Assessment	Classifying; Environmental Awareness; Estimating; Experimenting; Graphing (mathematics); Hypothesizing; Measuring; Observing; Predicting; Science Process Skills

Evaluation/Evidence of Effectiveness

The following evidence illustrates the effectiveness of the program: (1) active student involvement in science activities and investigations was observed in participating teachers' classrooms during the on-site visits; (2) increased involvement of workshop participants in science education projects at the local and state level; (3) several workshop participants who are working on Master's Degrees have selected research topics in science areas; (4) several alumni of the workshops are active members of the Biology Alliance and have made presentations; and (5) workshop participants demonstrate significant improvement in their science content knowledge and attitudes toward science.

Resources/Materials needed for Implementation

The science faculty of any college or university are capable of delivering the science content of these workshops. A commitment on the part of these faculty to working with area elementary teachers is required. Outstanding workshop participants should be recruited as lead teachers for the following year. They assist in the planning of the workshops and development of materials appropriate for elementary teachers. Materials necessary to replicate the plant portion of the program include Wisconsin fast plants, greenhouse plants, and seeds, as well as a variety of everyday items such as glue, paper, tinfoil, nylon screen, glass slides, thermometers, potato peelers, plastic pots, etc. The human biology workshop uses sheep brains, beef hearts, pig plucks, and three grade-specific educational packages from the American Heart Association. The animals and animal behavior workshop uses a variety of animals which could be maintained in the classroom (primarily invertebrates). Materials can be obtained from local garden stores, slaughterhouses, biological supply companies, grocery stores, hardware stores, and office supply companies.

Support

Several Academic Alliances which meet throughout the year are active at Moorehead State University. The Biology Alliance provides all workshop participants with an opportunity for long-term professional relationships and is a channel for communication with colleagues who share a common interest in biology.

Cost

The budget for the lead teacher is $2,000, with an additional $2,000 for teachers who accompany site visitors. Seventeen thousand dollars was received from the Eisenhower grant for release time, preparation time, and salary for on-site faculty visits. The Moorehead State University Office of Continuing Education provided $5,321 in salary and fringe benefits. This covered a two-week summer workshop and two one-credit workshops for summer migrant school teachers. Cost for supplies and equipment for workshop participants is approximately $25 per participant.

Contact: Dr. Mary Shimabukuro
Professor of Biology
Moorehead State University Biology Dept.
Moorehead, MN 56563
Telephone: 218-236-2359
Fax: 218-236-2168

Site(s): Moorehead State University
Biology Department
Moorehead, MN 56563

Source: Midwest Consortium for Mathematics and Science Education

HARPETH RIVER ENVIRONMENTAL AND EDUCATIONAL PROJECT

Williamson County Schools
Franklin, TN

Outdoor classroom provides secondary students with hands-on experience in chemical, biological, historical, and sociological research.

SUBJECT: Biology; Chemistry; Earth Science; Environmental Education; Mathematical Applications; Physical Sciences; Science and Society; Statistics; Technological Literacy

TARGET AUDIENCE: Grade 9-12 Educators; All Students

GENERAL DESCRIPTION

The Harpeth River Environmental and Educational Project is a major effort by the Williamson County, Tennessee school system to educate secondary school students, teachers, administrators, and the community about the deteriorating environment. The main goal of the program is to acquaint students in the sciences and humanities with the characteristics and importance of the Harpeth River. The project uses an outdoor classroom which provides students with hands-on experience in the theory and practice of chemical, biological, historical, and sociological research.

The project facilitates environmental education partnerships among Williamson County Schools and many local, state, federal, and private agencies. Subjects incorporated in the study are science, language arts, visual and performing arts, and social studies. Special education classes are also given the opportunity to be involved. In every group of honors science or English students visiting the river, a minimum of six special education students is included. Such inclusion in the project results in science concepts and skills reaching an often overlooked audience.

The project facilitates incorporation of the following four new instructional strategies into the school curriculum: (1) using extensive field activities; (2) stressing applied science; (3) incorporating science into other subject areas; and (4) using teams of teachers in a cross-curriculum thematic design. A typical activity is biological assessment of the river. Students are transported to a river site where they collect water samples and make a count of macro invertebrates (organisms used in water pollution analysis). A water quality rating is assigned based on the variety and number of organisms found.

(Year Initiated: 1993)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Guides; Enrichment Materials; Science Projects; Teacher Professional Development Materials; DOS Software	Cooperative Learning; Hands-on Learning; Independent Study; Journal Keeping; Peer Tutoring; Problem Solving Approach; Thematic Approach	Alternative Assessment; Attitude Surveys; Informal Assessment; Performance Assessment; Portfolios	Classifying; Collecting and Recording Data; Communicating; Environmental Awareness; Interpreting Data; Problem Solving; Science Process Skills

Evaluation/Evidence of Effectiveness

Educational indicators used to determine the effectiveness of the program included the following: (1) pre- and post-experience student questionnaire; (2) survey of parent and teacher perceptions; (3) student portfolio development in language arts class; and (4) numbers of participants. Parents, students, and teachers were enthusiastic about their experiences with the project. Each group cited their own increased levels of content knowledge and understanding as a key result of the project. The project continues to grow by word-of-mouth advertising, and new professional development opportunities are being planned.

Resources/Materials needed for Implementation

A week of training is recommended for those who wish to replicate the program. Materials required include curriculum materials (Southern Illinois Rivers Curriculum Project), a water pollution test kit, water quality test kit, and nets. Computer and modem are optional.

Support

Interest users groups ECONet (electronic bulletin board to support the Illinois Rivers Project) and Soiled Net (Southern Illinois Education Network), which is free to Illinois teachers.

Cost

Start-up cost is about $500 per teacher/class, including test kits, chemicals, and nets. The cost of each field trip is about $100, $40 to $50 for transportation and $50 for a substitute teacher. (One half of a class is taken each time.) The curriculum materials are about $12 per teacher.

Contact: Judy Butler
Gifted Education Coordinator
Williamson County Schools
1320 West Main St.
Franklin, TN 37064-3706
Telephone: 615-790-5880
Fax: 615-790-5588

Site(s): The program is being used at a number of sites, including: Illinois River Project, Streamwood High School, Streamwood, IL; Spring Hill High School, Maury County, TN.

Source: Eisenhower Math/Science Consortium at the Appalachia Educational Laboratory

IMAGE PROCESSING FOR TEACHING (IPT)

University of Arizona
Space Sciences Bu ding
Tucson, AZ

Microcomputer image processing offers grades 4-12 students an innovative approach to learn science and math concepts.

SUBJECT: Earth Science; Space Sciences; Mathematical Applications; Technology

TARGET AUDIENCE: Grade 4-12 Teachers; All Students

GENERAL DESCRIPTION

The goal of Image Processing for Teaching (IPT) is to provide professional development and curricular materials for a broad cross-section of teachers nationwide who are looking for innovative applications of technology to science and mathematics and the training necessary to implement them. IPT is an effective and enjoyable way to study the application of science and math to "real world" situations, as represented by digital imagery.

Using professional quality software on microcomputers, students explore a variety of scientific data sets, including biomedical imaging, Earth remote sensing and meteorology data, and planetary exploration images. They learn about the many mathematical concepts that underlie image processing, such as coordinate systems, slope and intercept, pixels, measurement, and statistics. The use of image processing is also an innovative method with which to engage students of all backgrounds in inquiry and discovery learning. By having the opportunity to create their own images to analyze and interpret, students and teachers change their traditional classroom roles and begin working together as a learning team.

Curriculum materials are available in many areas of mathematics and science for upper elementary and secondary levels, allowing this tool to be used with a variety of grade levels and student interests.

(Year Initiated: 1990)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Activity Books; Enrichment Materials; Integrated Materials; Tutorial Software; Teacher Workshops CD-ROMs; Compact Disks (data); Compact Disks (photo); Macintosh Software	Computer Assisted Instruction; Cooperative Learning; Discovery Learning; Hands-on Learning; Multimedia Instruction; Problem Solving Approach; Visual Learning	Alternative Assessment; Embedded Assessment; Group Assessment; Performance Assessment; Portfolios	Communicating; Controlling and Manipulating Data; Critical Thinking; Estimating; Interpreting Data; Mathematical Literacy; Measuring; Problem Solving; Science Process Skills; Thinking Skills; Visualizing

Evaluation/Evidence of Effectiveness

Primary evidence of effectiveness comes from student interviews and classroom observations by researchers and teachers. During the test phase of the project, site visits were made to each of the 85 participating teachers' classrooms. The classrooms were in a variety of settings, including urban, rural, and suburban; in all areas of the nation; and comprised students from different ethnic backgrounds and abilities. Image processing was found to be successful in attracting students, particularly females and other traditionally underrepresented groups in science and math, to engage in active inquiry and discovery. In many cases, at-risk or learning disabled students who previously had not been interested or engaged in school developed significant expertise in image processing and emerged as class leaders. Teachers reported that middle school students were especially attracted to the open-ended aspects of the inquiry-based approach.

Resources/Materials needed for Implementation

The training program is recommended for effectively implementing the program. Training can be done in a variety of formats to suit the needs of the teachers and districts involved. A set of workshop and curricular materials provides the necessary information for implementation. The materials come in two parts: a CD-ROM that contains the data and electronic versions of the activities and a notebook with printed copies of the activities and additional information.

Support

Follow-up resources include a toll-free telephone number, newsletter, electronic mail access, and an annual conference. Additional electronic resources being developed include a bulletin board and image archive.

Cost

The typical cost, including materials and follow-up support, is $100 per teacher, per day, plus expenses for a three to five day workshop.

Contact: Melanie Magisos
Media Projects Coordinator
University of Arizona
Space Sciences Building
Tucson, AZ 85721
Telephone: 602-621-1767
Fax: 602-621-5133
Internet Address: mmagisos@lpl.arizona.edu

Sites: The program is being used in hundreds of urban, suburban, and rural schools nationwide. Sites include: Dzilth-Na-O-Dith-Hle Community School (Navajo Reservation), Bloomfield, NM; Millard North High School, Omaha, NE; Baltimore City Public Schools, Baltimore, MD.

Source: Far West Regional Consortium for Science and Mathematics

INTERDISCIPLINARY APPROACH TO TEACHING SCIENCE FOR GRADES 6-8

Southern University and A & M College Center for Energy and Environmental Studies
Baton Rouge, LA

Summer teacher workshop develops positive scientific attitudes in middle school students.

SUBJECT: Scientific Literacy; Technological Literacy; Biological Sciences; Chemistry; Environmental Education; Nutrition Instruction; Energy; Science Projects

TARGET AUDIENCE: Grade 6-8 Teachers; All Students

GENERAL DESCRIPTION

Interdisciplinary Approach in Teaching Science for Grades 6-8 was developed to help teachers become more enthusiastic about teaching science so that they can motivate students to realize the significance and relevance of science in their daily lives. The goal of the program is to improve science education by increasing the scientific knowledge of teachers, encouraging an interdisciplinary approach to teaching science, and developing a positive scientific attitude among middle school students.

Participants begin the program with a four week intensive summer workshop in which they experience an interdisciplinary and thematic approach to learning. During the following school year, participants attend six follow-up workshops, are encouraged to develop their science professionalism, and receive direct assistance and support from the site coordinator. A one week follow-up session is held after the end of the school year to provide a time for participants to share their accomplishments and reflect on their growth. Plans for continued contact and networking opportunities provide ongoing support for lasting change.

Innovative features of the program include modeling reform methodology and its application in the classroom, use of themes and interdisciplinary connections, and use of computer technology. Participant professionalism is supported and encouraged by the project through professional organization membership, utilization of current science literature, networking with community partners, and assistance in writing and submitting grant proposals. Participants are shown how to involve parents in science reform efforts by having them take part in class along with their children. Implementation support is provided for participants throughout the school year through follow-up workshops, newsletters, and classroom visits by a site coordinator. Six hours of graduate credit are awarded upon completion of the program. Initial data indicate that change is occurring in both the content covered and the instructional strategies used by participants in their classrooms.

(Year Initiated: 1993)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Course Descriptions; Enrichment Materials; Integrated Materials; Books; Catalogs; Computer Software; Filmstrips; Interactive Video; Measurement Tools; Models; Posters; Slides; Transparencies; Videotapes	Cooperative Learning; Discovery Learning; Field Trips; Hands-on Learning; Interdisciplinary Approach; Issues Oriented Science; Journal Keeping; Multicultural Approach; Object Manipulation; Problem Solving Approach; Small Groups; Thematic Approach; Writing Across the Curriculum	Alternative Assessment; Concept Maps; Performance Assessment; Portfolios; Student Journals	Communicating; Conceptualizing; Critical Thinking; Environmental Awareness; Formulating Models; Problem Solving; Science Process Skills; Scientific Literacy

Evaluation/Evidence of Effectiveness

Of the 33 teachers involved in the program, the site coordinator has seen evidence of 29 participants actively using the methods and activities advocated in the program. Participant journal entries document incorporation of methodology and content reflecting program goals. There has also been an increase in science fair participation by students in participants' schools.

Resources/Materials needed for Implementation

To replicate the program a university faculty member and a full time site coordinator are needed. The site coordinator should be an experienced teacher who has used recommended strategies and content in the classroom and been involved in science education reform. The duties of the site coordinator include: planning and delivering workshops for participants; providing technical assistance and resources; demonstrating lessons; serving as a liaison between participants and university staff; producing a newsletter; collecting data; and keeping program records. Materials required include lessons from many different sources such as Great Explorations in Math and Science (GEMS), Lawrence Livermore Elementary School Science Study of Nature (LESSON), Chemical Education for Public Understanding Program (CEPUP), and others.

Cost

The only full time employee of the program is the site coordinator whose salary reflects that paid by the employing school district. The university personnel salaries are calculated based on time spent on the project. Estimated cost for teaching materials is from $500-$800. Costs for supplies vary; however, with one computer system they are $2000-$3000.

Contact: Dr. Ella Kelley, Dr. Diola Bagayoko and Dr. Nusrat Naqvi (Project Co-Directors)
Southern University and A & M College
Center for Energy and Environmental Studies
P.O. Box 9764
Baton Rouge, LA 70813
Telephone: 504-771-4724
Fax: 504-771-4722

Site(s): Southern University and A & M College
Center for Energy and Environmental Studies
Baton Rouge, LA

Source: Southwest Consortium for the Improvement of Mathematics and Science Teaching

INTERDISCIPLINARY ENVIRONMENTAL EDUCATION AND WATER STUDY PROGRAM

Huntingdon Area Middle Schools
Huntingdon, PA

Interdisciplinary environmental program for middle schoolers develops awareness of and concern about water resources.

SUBJECT: Environment; Scientific Methodology; Outdoor Education; Mathematical Applications; Social Studies; Technology

TARGET AUDIENCE: Grade 5-8 Teachers; Rural Students

GENERAL DESCRIPTION

The Interdisciplinary Environmental Education and Water Study Program for middle grades focuses attention on the resource of water. The program comprises curricular and instructional materials for developing students' awareness about and concern for water resources, and for taking action to protect them. Students learn that they are able to make a difference by helping to solve community water-related problems and that work on controversial water-related issues can achieve positive results for the community.

Many environmental topics are integrated into hands-on learning activities. The curricular materials can be utilized in social studies, science, mathematics, and language arts classes. An interdisciplinary team of teachers would best be able to maximize the potential of the program, although individual teachers also will find it useful. Environmental topics of study include acid rain, air pollution, groundwater, recycling, and water quality. Students learn inquiry skills (i.e., framing researchable problems, collecting data, analyzing data, interpreting data, formulating alternative solutions to problems) and to use technology to aid in the inquiry process. Among the many kinds of activities students actively engage in are brainstorming, discovery learning, experiments, field trips, individualized instruction, and small group work. Upon completing the program, students will understand the factors that interact in a watershed and may have a negative impact, and they will learn how to devise various means for resolving problems.

(Year Initiated: 1991)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Frameworks; Group Projects; Individual Projects; Individualized Materials; Individualized Programs; Integrated Materials; Lesson Plans; Program Descriptions; Supplementary Materials; Teacher-Developed Materials; Teaching Units; Units of Study; Calculators; Charts; Computer Software; Databases; Slides; Videotapes	Brainstorming; Cooperative Learning; Discovery Learning; Experiments; Field Trips; Hands-on Learning; Independent Study; Individualized Instruction; Interdisciplinary Approach; Problem Solving Approach; Small Groups; Visual Learning	Achievement Tests; Performance Assessment	Analyzing; Collecting and Recording Data; Communicating; Critical Thinking; Decision Making; Environmental Awareness; Interpreting Data; Problem Solving; Reasoning; Science Process Skills

Evaluation/Evidence of Effectiveness

There has been a 25% increase in student involvement in community action environmental efforts and; student competency in performing certain tasks such as collecting, analyzing, and interpreting data.

Resources/Materials needed for Implementation

Replication of this program requires access to a local stream and outdoor environment. Inservice for teachers on conducting water monitoring tests and a workshop on environmental issues are suggested before adoption.

Support

Support could be obtained from an interdisciplinary team of teachers, conservation agency personnel, water and waste treatment agency personnel, and high school students.

Cost

Cost is $50 per water monitoring kit.

Contact: Frederic R. Wilson
Teacher and Project Director
Huntingdon Area Middle Schools
2500 Cassady Ave.
Huntingdon, PA 16652
Telephone: 814-643-2900
Fax: 814-643-6244

Site(s): Huntingdon Area Middle Schools
Huntingdon, PA

Source: Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education

INTERNATIONAL STUDENT SPACE SIMULATION AND SPACE CAMPS

Lexington High School
Lexington, SC

Program provides opportunity for high school students to plan, construct, implement, and modify a simulated space flight mission.

SUBJECT: Aerospace Education; Mathematical Applications; Computer Science Education; Technology; Science Experiments; Science/Interdisciplinary Curriculum

TARGET AUDIENCE: Grades 9-12; Gifted/Honors Students; Suburban Students

GENERAL DESCRIPTION

The purpose of International Student Space Simulation and Space Camps is to allow high school students of varying ages, abilities, skills, and interests to design, build, operate, and evaluate a habitat for human beings that simulates a 72-hour space mission. They plan and provide all equipment, materials, and supplies necessary to support life and mission objectives.

During the simulation mission, students live in the habitat which they have constructed. The student astronauts conduct science and psychology experiments and other activities related to human habitation on board the space simulator. They also communicate with other international missions. While living in the space simulator, the student astronauts simulate actual space flight and orbit by using computer simulation programs. Students also design, construct, and operate a mission control that oversees the mission and supports the astronauts' work. Communication between the space station and mission control is accomplished through the use of video cameras, radios, and computers. Astronauts frequently keep up with missed school work by using videotaped and live lessons from mission control, computer assisted instruction or pre-assigned lessons.

An evening program permits the community to view the simulated mission and participate in other science activities. Tour groups, guided by students, can view the mission, as well as participate in hands-on, space-related activities at work stations. Lesson plans prepared for all age levels by teacher cadet students provide a district-wide theme of instruction during the mission. An overnight astronomy camp and a day rocketry camp for younger students offer opportunities to learn about space and space technology from older students.

(Year Initiated: 1990)

grade level
Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Lesson Plans; Manuals; Simulations; Supplementary Materials; Apple Software; DOS Software	Interdisciplinary Approach; Thematic Approach	Student Interviews	Communicating; Decision Making; Divergent Thinking; Experimenting; Planning; Problem Solving; Reasoning; Thinking Skills; Visualizing

Evaluation/Evidence of Effectiveness

The ISSS program and Space Camps are highly effective in promoting teamwork by students of various backgrounds and ability levels and in integrating learning from a variety of disciplines into a common goal.

Effectiveness of the program was judged by the following: (1) student interviews before and after the program; (2) participation of students from previous years; (3) recruitment of new students by their peers; (4) excitement level of students; and (5) faculty and administrative support and comments. Assessment comments were positive. The program has been supported by students' interest and their availability and willingness to work; school and district financial support for the continuation of the program; parent support of the mission, exchange program, and space camps; elementary and middle school feedback on lesson plans and tours; and elementary school involvement in art contests.

Resources/Materials needed for Implementation

Human resources required to implement the program vary with the extent and thrust of the program. The program is student centered, interdisciplinary, and can be adapted to any grade or age. Depending on the focus, an instructor is needed to oversee the program and provide expertise. For example, if computer simulation is the focus, an instructor with expertise in computer use will be needed. Although not essential, a text is available by contacting ISSS, 5 South High Oak Circle, Woodlands, TX 77380.

Support

A newsletter is published two or three times each year by the program director in Woodlands, Texas. Membership is available in ISSS. This organization provides a book to help teachers implement a new program. It also provides opportunities for teachers to participate in simultaneous activities with other school districts.

Cost

The cost of the Textbook/Guide is $15; membership in ISSS is $100 per school or school district.

Contact: Cathy Scott
Science Teacher
Lexington High School
2463 Augusta Highway
Lexington, SC 29072
Telephone: 803-359-5565
Fax: 803-359-8726

Site(s): Lisgar Collegiate Institute, Ottawa, Canada. (The initial program was conceptualized and implemented in Woodlands, Texas.)

Source: SERVE Mathematics and Science Regional Consortium

K-6 Science and Mathematics Enhancement Program (KSAM)

Southeast Missouri State University
KSAM Program
Cape Girardeau, MO

Teacher inservice program encourages use of process-based mathematics and science instruction in grades K-6.

Subject: Elementary School Mathematics; Elementary School Science

Target Audience: Grade K-6 Teachers; All Students

General Description

K-6 Science and Mathematics Enhancement Program (KSAM) is a teacher inservice and materials development effort implemented statewide in Missouri and serving more than 13,700 teachers to date. Its objective is to encourage utilization of an effective, process-based instructional strategy in K-6 science and mathematics. KSAM provides teachers with the following: process-based activities that enliven the classroom and excite the children; training in a process-based methodology; pertinent content material; experiences to allay their fears while bolstering confidence and motivation; and a support system to encourage the continuation of stimulating, process-oriented science and mathematics instruction.

Four inservice courses are offered, one each in earth science, life science, physical science, and mathematics. From the courses, teachers learn how to use process-based instructional strategies in their classrooms. The KSAM Activity Guide Series contains student activities and teacher information and provides teachers with instructional material to support an investigative, process-centered teaching approach. For example, in a lesson on rock weathering, students learn that rocks bouncing and rubbing against each other in water causes them to wear down. This type of weathering, called abrasion, is an important process in the breakdown of rock. By shaking rocks and water in a plastic bottle, students simulate the action of rocks moved by water. When the sample is inspected, little bits of rock broken by the shaking action are found in the water and illustrate the abrasion process.

A variety of indices document the success and impact of the KSAM Program, one of which is its selection by the U.S. Department of Education as a national meritorious teacher inservice program.

The Activity Guides are currently being revised and will be published commercially by Curriculum Associates. The guides will be written for grade levels K-1, 2-3, and 4-6, making them more useful for classroom teachers.

(Year Initiated: 1985)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Manuals; Resource Units; Teaching Units; Units of Study; Teacher Guides; Teacher Professional Development Materials; Books	Cooperative Learning; Experiments; Hands-on Learning; Individualized Instruction; Peer Tutoring; Problem Solving Approach	Attitude Surveys; Informal Assessment	Communicating; Comparing; Conceptualizing; Critical Thinking; Generalizing; Mathematical Literacy; Problem Solving; Reasoning

Evaluation/Evidence of Effectiveness

Program effectiveness was evaluated by course evaluations; observations of instructors; and pre- and post-course surveys of teacher attitudes, content taught, and teaching methodologies. In addition, extensive statistical evaluation indicates that teacher participation in KSAM inservice courses results in highly significant impact on their content adequacy, attitudes, and instructional methodologies, especially in using an activity-based, process approach. Teachers participating in KSAM also reported significant increase in affective responses and cognitive performance of students in their own classrooms. Data in this study further suggest that the KSAM impact is maintained by teachers well beyond termination of the inservice training. Pre post data comparison showed significant change in attitudes, teaching methodologies, and course content.

Resources/Materials needed for Implementation

To replicate the program the following human resources are needed: (1) an individual to administer the program with quarter to half released time for this purpose; (2) quarter to half-time secretarial assistance, depending on the scope of the program; (3) an initial or "starter" group of eight to 30 Lead Teacher candidates, depending on the planned scope of the program (KSAM started with four); and (4) a consultant from the KSAM program (optional). In addition, the KSAM activity guides are needed.

Support

A newsletter and regional conferences provide additional support to teachers.

Cost

Costs include: $500/day plus expenses for KSAM consultant; $25,000 for 30 Lead Teachers for one week training, including housing, travel, and a stipend.

Contact: Dr. Ernest L. Kern
Project Director
Southeast Missouri State University
KSAM Program One University Plaza
Cape Girardeau, MO 63701
Telephone: 314-651-2593
Fax: 314-651-2223

Site(s): University of Idaho, College of Education, Moscow, ID and Southwestern Oklahoma State University, Weatherford, OK are using the program materials. The entire program is being used in the School of Education at Kean College in Union, NJ.

Source: High Plains Consortium for Mathematics and Science

THE KENILWORTH MATHEMATICS PROJECT

Harding School
Kenilworth, NJ 07033

Ongoing teacher development program improves K-8 mathematics instruction.

SUBJECT: Elementary School Mathematics; Mathematical Applications; Mathematical Concepts; Mathematics Skills; Technological Literacy

TARGET AUDIENCE: Grade K-8 Educators; All Students

GENERAL DESCRIPTION

The Kenilworth Mathematics Project is an ongoing teacher development program in which teachers responsible for mathematics instruction move from the traditional role of classroom "manager" to that of facilitator. The program goal is to enable teachers to create classroom environments in which math concepts and procedures can be constructed by students during the course of their problem solving efforts.

All teachers responsible for mathematics instruction were involved in inservice activities for three years. The project was limited to a single school and included not only the teachers, but also the school administrators as active participants in inservice sessions. Throughout the project there have been three interrelated emphases, each of which has been a prominent part of inservice activities, accompanying research, and implementation into classroom instruction. These emphases are: (1) teachers as learners of mathematics; (2) attention given to children's mathematical thinking through videotaping, analyzing, and reflecting about episodes in which a small group of children (or a single child in an interview situation) is engaged in thoughtful mathematical activities; and (3) ongoing partnerships between project staff and the teachers as they develop ways to implement the ideas of the project into their classroom instruction.

Through the workshops, teachers recognize that the experience of solving problems is not a prescribed program, but a process that necessarily involves making mistakes. Children recognize the mistakes, not because they are told so by the teacher, but because they discover that the proposed ideas do not necessarily work to contribute to the solution of the problem. Hence, teachers recognize that children's mistakes are an important part of learning. They recognize too, that ideas that work become part of a repertoire of concepts useful in problem solving. A critical component of the project is developing flexibility in teachers' instructional strategies achieved through the services of a half-time on-site consultant.

(Year Initiated: 1984)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Calculators; Manuals; Manipulative Materials; Videos	Hands-on Learning; Journal Keeping; Object Manipulation; Problem Solving Approach; Small Groups; Thematic Approach	Achievement Tests; Alternative Assessment; Informal Assessment; Interviews; Norm Referenced Tests; Tests	Communicating; Critical Thinking; Observing; Planning; Problem Solving; Reasoning; Thinking Skills

Evaluation/Evidence of Effectiveness

Analysis of student test scores on the Iowa Test of Basic Skills from 1983 to 1991 indicate an increase in problem solving and conceptual knowledge without significant change in computational performance. Studies of individual children's thinking within Kenilworth classrooms by researchers at Rutgers University also indicate strong ability to analyze and solve problems. Informal student surveys show mathematics to be a favorite subject. Teacher leaders begin to emerge and subsequently assume leadership roles within the project.

Resources/Materials needed for Implementation

Materials needed for replication for a fourth grade class of twenty include: pattern blocks ($90), geoboards ($53), cuisenaire rods ($249), base ten blocks ($184), calculators ($159), chip trading ($225) and, teacher resource books ($200). These materials, which can be shared by two or three teachers, cost a total of $1160. Blank videos and demonstration videos of students engaged in problem solving are also needed, as are workshops for teachers and administrators for a three year period, on-site consultants to act as mentors, and substitute teachers.

Support

N/A

Cost

See Resources/Materials for Adoption for cost of materials. Other costs include: equipment - two video cameras at $1,000 each; workshops - $3000; and a mentor for 20 hours per week - $15,000.

Contact: Marcia O'Brien
Supervisor of Math, Science, and Computer Ed.
Harding School
426 Boulevard
Kenilworth, NJ 07033
Telephone: 908-276-5936
Fax: 908-276-7598

Site(s): New Brunswick Schools, New Brunswick, NJ; Colts Neck Public Schools, Colts Neck, NJ; The Rabbi Pesach Raymon Yeshiva, Edison, NJ.

Source: Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education

KIDS INVESTIGATING AND DISCOVERING SCIENCE

University of California, Irvine
School of Biological Science
Irvine, CA

Three-week intensive summer program of science for at-risk elementary students with limited English proficiency.

SUBJECT: Elementary School Science; Scientific Methodology; Technological Literacy

TARGET AUDIENCE: Grades K-8; At-Risk Students; Bilingual Students; Culturally Diverse Classrooms; Parents

GENERAL DESCRIPTION

The Kids Investigating and Discovering Science (KIDS) program began in 1990 at the University of California, Irvine (UCI) to establish a national model program of elementary science instruction for at-risk elementary students. The KIDS staff has developed and implemented innovative elementary curricula to teach valuable concepts in the physical, environmental, and biological sciences. Every year 120-150 elementary students with limited English proficiency are brought to UCI for a three-week intensive program of science instruction.

The KIDS program accomplishes the following tasks: (1) implements and disseminates an exemplary science program for grades K-8; (2) develops new physical, environmental, and biological science curricula; (3) institutes a national program of teacher training for new and current teachers that will enhance their preparation for science education; and (4) conducts a longitudinal study to evaluate methods that research institutions use to provide leadership in addressing the under-representation of minorities in the sciences.

A series of bilingual lesson plans has been developed to illustrate the importance of science and its relationship to the students' world. The lessons in physical, environmental, and biological science incorporate hands-on experimentation and have been designed to develop critical thinking and communication skills. The lessons are taught bilingually to encourage absorption of the materials, because younger students with limited English are reluctant to participate in the English-only classroom. An atmosphere of open communication between students and teachers helps provide the bilingual students with the confidence they need for effective learning. The program is further enhanced by after-school and weekend sessions with parents and students reviewing the curricula.

(Year Initiated: Summer 1989)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Learning Centers (classroom); Manipulative Materials; Multilingual Materials; Parent Materials; Teacher Workshops; Apple Software; Macintosh Software; Measurement Tools; Models; Slides; Transparencies; Videodiscs; Videotapes	Computer Managed Instruction; Demonstrations; Discussion; Field Trips; Independent Study; Interdisciplinary Approach; Journal Keeping; Multimedia Instruction; Oral Reports; Problem Solving Approach; Small Groups; Visual Learning	Attitude Surveys; Informal Assessment; Interviews; Observation; Performance Assessment; Scoring Rubrics; Student Journals	Collecting and Recording Data; Communicating; Comparing; Conceptualizing; Critical Thinking; Hypothesizing; Interpreting Data; Observing; Science Process Skills; Scientific Literacy

Evaluation/Evidence of Effectiveness

Parent comments, pre- and post-test student attitudes, and teacher comments were used to evaluate program effectiveness. Students' attitude toward science changed greatly, especially with respect to women's access to science and an increased interest in choosing science, engineering, and mathematics careers. Students look forward to participating each summer. Teachers noted marked improvement in children's attitudes and willingness to actively participate in all class projects, especially science. Children responded positively to mentoring by teaching assistants. They were eager to share with their peers the knowledge and expertise developed during the summer program.

Resources/Materials needed for Implementation

The science curriculum changes every year as resource availability varies. It has included biology, biomedical science, and computer and physical sciences. Materials are selected from donated university resources and adapted for each level. Problem-solving experiences can be created on the computer or with relatively inexpensive materials. In some cases, kits can be purchased and shared. Standard school supplies are provided by the participating school. The human resources required to implement the program are: one research-oriented program director, one curriculum developer, two undergraduate student assistants, two K-12 bilingual instructors, and one administrative assistant. Other resources needed are transportation and lesson translation, if Spanish versions are not provided.

Support

Consultation services can be provided by the director, and brief answers can be provided by the director and curriculum developer over the phone. Teacher training is provided, but the requesting institution is expected to cover all transportation, lodging, and incidental expenses.

Cost

The estimated cost for equipment is $19,300.

Contact: Ms. Nydia Hernandez
Associate Director of KIDS
University of California, Irvine
2730 N. Flower
Santa Ana, CA 92706
(Mail Inquiries Only)

Site(s): Carver, Fremont, Hoover, Jackson, and Pio Pico Elementary schools, and Carr, Spurgeon, and Willard intermediate schools in the Santa Ana Unified School District; schools in Los Angeles, Placentia, CA and Texas.

Source: Far West Regional Consortium for Science and Mathematics

KINDERGARTEN SCIENCE: FOUNDATIONS FOR UNDERSTANDING

Carroll County Maryland
Carroll County Board of Education
Westminster, MD

Kindergarten science curriculum and staff development program train kindergarten teachers to actively engage students in science.

SUBJECT: Biological Sciences; Elementary School Science; Physical Sciences

TARGET AUDIENCE: Kindergarten Teachers; Culturally Diverse Classrooms

GENERAL DESCRIPTION

Kindergarten Science: Foundations for Understanding is a science staff development program for kindergarten teachers. The program is based on constructivist theories which view learning as an organic process of invention rather than a mechanical process of accumulation. Kindergarten teachers, assisted by scientists and educators from colleges and universities, developed a hands-on curriculum which focuses on change and includes units in life and physical sciences.

Using the process of assimilation and accommodation, children begin constructing knowledge about their world. All lessons incorporate the constructivist approach to learning and include performance assessment tasks for each unit. Presently, the curriculum comprises four units: (1) caterpillars and butterflies; (2) animals and plants that live in water; (3) animals and plants that live on land; and (4) liquids. The curriculum guide contains complete lessons with activities and developmentally appropriate literature. Suggested activities/experiences, such as working with animals and plants, actively engage children in science as they observe through exploration. For instance, in the water habitat unit, students construct an aquarium, add two plants and two animals, make daily observations, and use hand lenses to see snail eggs and parts of tiny plants.

The program focuses on the children's activities, not on the teacher. Children learn to observe, communicate, compare and contrast, sort, and order. As an integral part of the program, students learn to record by measuring and noting the size of monarch caterpillars and tracking the growth and germination of seedlings. The program complements other areas of the curriculum and provides a means for developing critical thinking and reasoning skills.

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Guides; Enrichment Materials; Manipulative Materials; Resource Units; Teacher Professional Development; Materials Kits	Cooperative Learning; Discovery Learning; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Problem Solving Approach; Thematic Approach	Alternative Assessment; Holistic Evaluation; Informal Assessment; Performance Assessment; Student Journals	Environmental Awareness; Listening Skills; Metacognition; Observing; Planning

Evaluation/Evidence of Effectiveness

The following techniques were used to determine the effectiveness of the program: Survey on Teaching Science; Science Content Measure; Nature of Scientific Knowledge Scale; and Stages of Concern. All teachers involved have expressed an increased level of confidence in their ability to teach science and have increased their science literacy.

Resources/Materials needed for Implementation

The program curriculum guides, science kit, live materials, and a minimum of two days training are essential for replication.

Support

Participant support meetings.

Cost

Costs include: $15, plus postage, for project materials; $350 per day for project training given by consultant; science kits - $200 each; and live material - about $100.

Contact: Mr. Michael P. Perich
Supervisor of Elementary Schools
Carroll County Maryland
Carroll County Board of Education
55 North Court Street
Westminster, MD 21157
Telephone: 410-848-8280
Fax: 410-876-9224

Site(s): All Carroll County, MD elementary schools, North Grafton Elementary School, North Grafton, MA; Redmond School District, Redmond, OR

Source: Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education

LINKING HOME AND SCHOOL WITH PASS (PORTABLE, AFFORDABLE, SIMPLE SCIENCE)

Wilmington Manor Elementary School
New Castle, DE

Take-home science "Lesson Bags" use hands-on approach to teach basic science concepts.

SUBJECT: General Science; Language Arts; Number Concepts; Science Projects

TARGET AUDIENCE: Grades pre K-1; At-Risk Students; Culturally Diverse Classrooms

GENERAL DESCRIPTION

Linking Home and School with PASS (Portable, Affordable, Simple Science) was developed to make science fun, meaningful, and rewarding for grade pre-k-1 students, teachers, and parents. It uses a simple, multisensory, hands-on approach and links home and school to provide developmentally appropriate, cross-disciplinary, enjoyable science experiences.

The program is structured around hands-on experiences that permit all students, regardless of background, experience, or ability, to be actively involved. Lessons are devised to encourage students to think and to learn that science is everywhere. There are no right or wrong answers; children are given the opportunity to learn from their mistakes as well as their successes. All materials for each lesson are packed in zippable plastic bags. Every child has his or her own "lesson bag" for each of the 15 lessons in the PASS program. The materials are safe, inexpensive, and readily available. Initial introduction and lesson presentation are done with the whole group, after which the bag and a direction/follow-up sheet are sent home for review and further study. Only the follow-up work is returned to school. The "lesson bag" of materials is the child's to keep at home for work and enjoyment. The science skills learned—observing, communicating, classifying, reasoning, measuring, inferring, and predicting—can all be reviewed and enjoyed at home with family and friends. Through this mechanism, parents are encouraged to participate actively in their child's learning.

Learning centers and cooperative learning activities are used for lesson reinforcement. The 15 lessons encompass all areas of the curriculum, taking an in-depth look at the five senses and introducing the study of air, water, mixtures, liquids, solids, plants, and surface tension. An example "lesson bag" is "Reach Out and Touch" that uses sandpaper, poster board, cotton, corrugated cardboard, a plastic party fork with a round top, and a paper plate on which to organize the objects to teach that one of the five senses is touch.

(Year Initiated: 1990)

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Manipulative Materials; Parent Materials; Resource Units; Workshops; Books; Kits	Activities; Cooperative Learning; Discovery Learning; Discussion; Experiments; Hands-on Learning; Interdisciplinary Approach; Object Manipulation; Peer Tutoring; Problem Solving Approach; Thematic Approach; Whole Language Teaching Approach	Alternative Assessment; Holistic Evaluation; Informal Assessment; Interviews; Performance Assessment	Classifying; Communicating; Critical Thinking; Experimenting; Listening Skills; Logical Thinking; Predicting; Problem Solving; Reasoning; Science Process Skills; Scientific Literacy; Thinking Skills

Evaluation/Evidence of Effectiveness

Assessment of learning outcomes is primarily from parent and teacher feedback and teacher observations of actual behaviors. The following indicators confirm the success of the program: 100% return of all follow-up work assignments with indications that parents and children reviewed the lessons; excellent year-end responses from parents; standing room only at most workshops; requests from teachers, parent groups, and civic associations to share the program; and positive written responses from parents.

Resources/Materials needed for Implementation

To replicate the program, copies of the lessons are needed along with objects outlined in each lesson. Zippable plastic bags and paper plates are used for organizing "lesson bags" that can be prepared by an interested teacher, assisted by one or two parents. Attending a workshop before implementation is suggested.

Support

N/A

Cost

"Lesson bags" cost about 20 cents each. There is a small cost for a copy of the PASS program. Many of the materials for the bags can be acquired from donations.

Contact: Renee G. O'Leary
Caravel Academy
2801 Del Laws Road
Bear, DE 19701-1799
Telephone: 302-834-8938

Site(s): Lancashire Elementary School, Brandywine School District, Wilmington, DE; Brookside Elementary School, Christina School District, Newark, Del; Science in Rural California Project.

Source: Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education

MACINTOSH-USING SCIENCE TEAMS (MUST)

Miami Museum of Science
Miami, FL

Summer camp provides middle school minority youth with an in-depth marine science enrichment experience.

SUBJECT: Marine Biology; Computer Science Education; Environment; Scientific Methodology; Mathematical Applications; Ecology

TARGET AUDIENCE: Grades 7-9; Minority Students; Urban Students

GENERAL DESCRIPTION

The Macintosh-Using Science Teams (MUST) Summer Camp provides Miami, Florida minority middle school students with an in-depth marine science enrichment experience. Forty-eight students in grades 7-9 attend a four-week session during the summer. They are divided into small research teams for cooperative group investigation of a topic within the general theme of human impact on the marine environment.

Each day, the students participate in a 45 minute interactive seminar on a marine science topic. Then, they directly apply what they have learned during field investigations at the nearby Biscayne Bay and Atlantic Ocean shorelines. The teams apply scientific methods while collecting information about their selected topics and use professional sampling and measuring instruments to conduct qualitative and quantitative surveys of the coastal marine ecosystems. This information is later discussed, analyzed, and processed in the computer lab. Computer technology is infused into all aspects of the program. Students use computers to record observations in a daily log and to access databases through telecommunication networks and optical media. They also process data with spreadsheet applications and use graphing tools to draw maps and charts from field surveys. Throughout the project, students' families are involved in helping to ensure students' success, for example by encouraging their children to attend regularly. The summer camp culminates with a Family Night, during which each team uses a variety of multimedia techniques to present a report of their findings.

Camp leadership and management are implemented by a marine scientist from the Miami Museum of Science and a science teacher from Dade County Public Schools who collaborate on all aspects of the program.

(Year Initiated: 1989)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Manuals; Program Descriptions; Student Projects; Teacher Workshops; Books; CD-ROMs; Computer Software; Databases; Interactive Video; Macintosh Software; Measurement Tools	Cooperative Learning; Discovery Learning; Discussion; Informal Education; Interdisciplinary Approach; Journal Keeping; Multicultural Approach; Peer Tutoring	Student Journals	Communicating; Critical Thinking; Environmental Awareness; Hypothesizing; Interpreting Data; Measuring; Observing; Problem Solving; Science Process Skills

Evaluation/Evidence of Effectiveness

The success of the MUST program in increasing and maintaining the interest of minority middle school students in science, mathematics, and technology is evident in the students' attendance records, performance in school, and continued involvement in science activities.

Surveys conducted on participants before and after the completion of the program indicate a positive change in attitudes and preferences towards science and mathematics. Students' daily journals and research project reports indicate increased motivation and interest in the program content and methods. Attendance rate remained high (90% didn't miss a day, 10% missed maximum of three days). In a survey conducted in 1992 on a random sample of 35% of MUST alumni, 89% are either taking (or are planning to take) advanced level science courses; 79% indicated that MUST significantly influenced their interest in science; 98% indicated that MUST increased their awareness of science careers; 100% indicated that MUST increased their awareness of environmental problems; and 100% expressed an interest in continuing their relationship with the Miami Museum of Science.

Resources/Materials needed for Implementation

The following human resources are required for replication: (1) one marine scientist experienced with computers, youth mentoring, snorkeling, and the local environments; (2) one middle school science teacher familiar with computers and the local environments and with adequate water skills; and (3) one undergraduate or graduate student in a scientific or technological discipline to function as assistant mentor. The essential materials are PVC hydraulic pipe, wood stakes, polypropylene or nylon rope, buckets, lab glassware, acrylic plastic writing tablets, markers, and nets.

Support

A MUST teacher inservice institute is conducted yearly during the spring recess. Program documentation is available upon request. Contact Alberto Ramirez or Catherine Raymond at the Miami Museum of Science.

Cost

Costs include: staff for two four-week summer sessions - $15,000-$16,000; materials for every 24 students - about $600; computers - $1,200 each; scanner - $1,000; printer - $300-$1,500; lab and field equipment - $1,500; snorkeling equipment - $3,000.

Contact: Alberto Ramirez
MUST Co-Director
Miami Museum of Science
3280 South Miami Avenue
Miami, FL 33129
Telephone: 305-854-4247 ext. 257
Fax: 305-285-5801
Internet Address: musetech@igc.apc.org

Site(s): Some elements of MUST have been applied in Cutler Ridge Middle School and Horace Mann Middle School, Miami, Florida.

Source: SERVE Mathematics and Science Regional Consortium

MARE:

MARINE ACTIVITIES, RESOURCES AND EDUCATION

Lawrence Hall of Science
University of California
Berkeley, CA

Interdisciplinary teacher training and curriculum development provide ocean studies activities for grades K-8.

SUBJECT: Earth Science; Ecology; Environment; Science and Society

TARGET AUDIENCE: Grade K-8 Educators; At-Risk Students; Bilingual Students; Culturally Diverse Classrooms; Minority Students

GENERAL DESCRIPTION

MARE: Marine Activities, Resources and Education is an interdisciplinary, marine science teacher training and curriculum development program that transforms elementary and middle schools into laboratories for the exploration of the ocean. The program is designed specifically to include language minority students and culturally diverse schools through the use of sheltering techniques and cooperative learning. MARE helps schools to conduct year-round ocean studies activities, highlighted by Ocean Week, an intensive immersion-style event that encourages collaboration among the entire staff, student body, and community.

To prepare schools for their ocean studies activities, MARE provides all faculty inservices, including an intensive, residential summer institute (usually attended by one to three teachers from each school), and an extensive, interdisciplinary curriculum that is correlated to the California science and language arts frameworks. MARE staff provide direct, in-class coaching support to classroom teachers, and dispense books, videos, and kits from a multimedia library. Each grade level within the MARE curriculum focuses on a different ocean habitat and its corresponding environmental issues.

For example, third graders study shore birds. One aspect of their study is how diversity of prey and variation of bird beak type leads to natural partitioning of resources. Students participate in a "Bird Beak Buffet" where they role play different types of birds with different types of beaks. The players "feed" on different types of food available to shore birds. They collect data on which beak types are best suited for different types of food, and they graph and interpret their findings. The MARE curriculum is correlated to the themes, concepts, and organizing questions described in the California Science Framework.

(Year Initiated: 1991)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Bilingual Materials; Curriculum Guides; Enrichment Materials; Group Projects; Integrated Materials; Training Programs; Student Projects; Teacher Workshops; Audiotapes; Bibliographies; Books; CD-ROMs; Charts; Kits; Models; Photographs; Picture Books; Posters; Realia; Slides; Videotapes	Cooperative Learning; Discovery Learning; Field Trips; Hands-on Learning; Interdisciplinary Approach; Multicultural Approach; Multimedia Instruction; Thematic Approach; Visual Learning; Whole Language Teaching Approach; Writing Across the Curriculum	Alternative Assessment; Embedded Assessment; Group Assessment; Performance Assessment; Portfolios	Abstract Reasoning; Collecting and Recording Data; Creative Thinking; Critical Thinking; Decision Making; Environmental Awareness; Experimenting; Graphing; Hypothesizing; Interpreting Data: Listening Skills; Metacognition; Planning; Predicting; Problem Solving; Sequencing

Evaluation/Evidence of Effectiveness

Teachers reported an increase in knowledge of and comfort with science and improved attitudes toward science for themselves and their students. Principals reported decreases in student absenteeism, discipline problems, vandalism, and racial incidents. Teachers indicated that they worked together with colleagues more often and more successfully. Teachers and evaluators reported that language minority students acquire English faster when they participate in the program. Extensive case studies based on pre/post interviews, questionnaires, and observations of schools in the program have been developed. Most data are formative at this point. A bilingual education evaluator is currently looking specifically at the rates at which LEP students acquire English.

Resources/Materials needed for Implementation

Human resources and training suggested for implementation are: (1) one to three teachers to attend the MARE summer institute (optional); (2) two to three days of training with the entire staff together; (3) assistance planning and coordinating the school's first ocean week or month; and (4) MARE staff on-site at school providing in-class support, coaching, and guided practice for every teacher during ocean week (optional). Materials needed are the MARE teachers guides to marine habitats; various supplemental instructional materials and locally available materials for experiments and hands-on activities.

Support

There is a mailing list for special announcements. A newsletter will begin within six months.

Cost

Costs include: $2,200 - summer institute, including stipend, materials, room/board; $3,000-$15,000 - remaining expenses, depending on the needs at each school site; $35 - each teacher guide; $20-$50 - supplementary materials, per teacher; $20-$100 - locally available materials, per teacher.

Contact: Craig Strang, Director
Lawrence Hall of Science
University of California
Berkeley, CA 94720
Telephone: 510-642-5008
Fax: 510-642-1055
Internet Address: marc@maillink.berkeley.edu

Site(s): Approximately 200 schools nationally, including the following regional dissemination sites: Nevada MARE leadership team—supporting approximately 40 schools in Washoe County, NV; University of Texas Education Services; Colorado MARE leadership team—supporting eight schools in Pueblo, CO.

Source: Far West Regional Consortium for Science and Mathematics

MATH^3

University of Pittsburgh, LRDC
Pittsburgh, PA

Research-based math instruction enhances achievement in primary grades, especially minority and economically disadvantaged students.

SUBJECT: Elementary School Mathematics; Mathematical Applications; Mathematical Concepts; Mathematical Logic; Mathematics Skills

TARGET AUDIENCE: Grade K-3 Teachers; At-Risk Students; Culturally Diverse Classrooms; Economically Disadvantaged Students; Limited English Proficiency (LEP) Students; Minority Students

GENERAL DESCRIPTION

Math^3 is a research-based method of instruction designed to enhance the performance of primary students in mathematics, especially those from minority and economically disadvantaged groups. It is built around whole class and small group discussion of children's invented solutions to arithmetic problems. Based on a multi-year program of research on the development of mathematical intuition in children, the program promotes invented solutions to everyday problems, many proposed by children or their parents. It combines extensive use of manipulative materials with early introduction of formal notation and requires children to justify and explain solutions as well as carry them out. Preliminary results from a qualitative study that compared Math^3 classrooms with matched non-Math^3 classrooms show three areas in which Math^3 differs from a more traditional approach to teaching mathematics: the program's specific focus on thinking and metacognitive strategies; students' engagement in the subject matter; and the use of group-based work.

Math^3 professional development includes teams of teachers who support their peers' first efforts to incorporate the Math^3 philosophy in their teaching and assessment. There is also a regular program of working sessions that include analysis of videotaped lessons, discussions of research, and refinement of program goals. These activities complement a regimen of intensive classroom support that includes modeling, coaching, and co-teaching by veteran Math^3 teachers. Math^3 teachers have changed the way they instruct math and how they view mathematics teaching and learning.

(Year Initiated: 1990)

62

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Activity Books; Assessment Materials; Lesson Plans; Workshops; Teacher Background Materials; Teacher-Developed Materials; Teacher Guides; Teacher Professional Development Materials; Teacher Workshops; Kits; Transparencies	Cooperative Learning; Hands-on Learning; Problem Solving Approach; Self-Directed Groups; Small Groups; Thematic Approach	Alternative Assessment; Holistic Evaluation; Informal Assessment; Performance Assessment	Communicating; Computational Operations; Conceptualizing; Decision Making; Estimating; Mathematical Literacy; Metacognition; Reasoning; Recognizing Patterns; Spatial Ability; Thinking Skills

Evaluation/Evidence of Effectiveness

In addition to markedly improving the achievement of economically disadvantaged minority students, Math³ has benefitted children from many different schools and classrooms. When the standardized test performance of project classes is compared with non-project classes, the Math³ project indicates significant benefits for kindergarten and first grade students. The impact of the project in second grade classes is not as clear. There is significant correlation when the number of years of teaching experience is paired with student performance in second grade; i.e., years of teaching experience appears to have an impact on the effectiveness of second grade teachers. Teachers' reports and staff observations reveal that students are excited about math class and appear to be more engaged than when taught by traditional methods. Work samples from students, when compared informally with peers in non-Math³ classrooms within a school, show that Math³ students are successfully tackling more sophisticated concepts than their peers.

Resources/Materials needed for Implementation

To replicate this program the following are needed: a store of multiple forms of manipulatives, overhead projector manipulatives, copying services (each teacher receives black masters of appropriate handouts for students which require duplication), and lessons from the Math³ office. A week of summer inservice and one-half to one day inservice per month during the school year for two consecutive years are required. The following are needed for each inservice session: clerical assistance for facilitating teachers or senior staff members; three facilitators per session; flexible school administrators; and funds to cover costs for teacher time outside of regular school hours. Support initially provided by a Math³ senior staff member includes demo-teaching, co-teaching, coaching, and observing. These functions are taken over eventually by district teachers. Administrator support is very important.

Support

Support can be obtained from the Learning Research Development Center (LRDC).

Cost

Support services for ten teachers costs $6,500 for 13 sessions per year.

Contact: Vicki Bill
Project Coordinator
University of Pittsburgh, LRDC
3939 O'Hara Street
Pittsburgh, PA 15260
Telephone: 412-624-8545
Fax: 412624-9149

Site(s): 79 teachers in 22 sites in Pennsylvania. Primary sites include Aliquippa School District, Connellsville School District, and the Diocese of Pittsburgh schools.

Source: Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education

MATH VANTAGE

Nebraska Mathematics Coalition
Lincoln, NE

Middle school math program promotes active student involvement and integrates practical applications and enrichment activities into the curriculum.

SUBJECT: Mathematical Applications; Geometric Concepts; Mathematics Skills; Number Concepts; Rational Numbers; Symmetry

TARGET AUDIENCE: Grades 5-8; Culturally Diverse Classrooms; Female Students; Minority Students

GENERAL DESCRIPTION

The main goal of the Math Vantage program is to excite more students, particularly females and minorities, about mathematics and get them to apply it to their everyday lives. The seventh and eighth grades in mathematics are often repetitive and do not prepare students for a smooth transition to algebra and geometry. In addition, older math materials are often deficient in interdisciplinary and multicultural arenas and do not adequately encourage females. Math Vantage materials address these problems by presenting mathematics from a different perspective—a different "vantage" point.

Math Vantage is a product of Nebraska mathematics teachers under the leadership of project consultants and the project leader. Currently, the materials consist of videos and print materials for student units on patterns and spatial sense; and a teacher unit on cooperative learning. Other units that will be developed and released over the next three years include student units on data analysis, number theory, and proportional reasoning and teacher units on assessment and visualization. The materials promote active student involvement and integrate practical applications and enrichment activities into the curriculum. For example, short, fast-paced, energetic videos set the stage for mathematics instruction by blending the world of the 13 year old with that of the adult. The accompanying print material builds on the videos, using enrichment activities as the primary vehicle of mathematical instruction. Students are encouraged to take responsibility for their own learning by reading and communicating mathematics. They also develop problem-solving strategies and reasoning skills within the context of the materials.

Field tests have shown that the Math Vantage materials are well received by teachers and students for several reasons. Not only do the materials address the special needs of middle level students, but they also help teachers meet the instructional challenges presented by the NCTM Standards. The materials help teachers and students expand their mathematical knowledge and show them how mathematics relates to their everyday lives.

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Resource Units; Teacher-Developed Materials; Videotapes	Cooperative Learning; Experiments; Hands-on Learning; Interdisciplinary Approach; Multicultural Approach; Multimedia Instruction; Problem Solving Approach	Alternative Assessment; Holistic Evaluation; Informal Assessment; Performance Assessment	Critical Thinking; Generalizing; Interpreting Data; Mathematical Literacy; Problem Solving; Reasoning

Evaluation/Evidence of Effectiveness

Program effectiveness was determined by using field tests that included student and teacher evaluation forms, survey forms with Likert scales, and qualitative comments. Math Vantage materials were seen as enjoyable, active, and relevant. They received very high ratings for the energetic videos and the amount of active involvement. Data indicate that as a result of using the Math Vantage materials, teachers and students are expanding their mathematical knowledge and relating it to their own experience.

Resources/Materials needed for Implementation

Training requirements depend on the backgrounds of teachers implementing the program. Math Vantage developers can give workshops. The student and teacher units are required for replication.

Support

Newsletter is in planning stage.

Cost

Materials are free to Nebraska teachers; others should consult current Sunburst and Great Plains catalogs. Consultant fees for teacher inservice are negotiable for services, plus travel and costs for expenses.

Contact: Dr. DeLoris Tonack
Project Leader
Nebraska Mathematics Coalition
126 North 11th Street P.O. Box 880326
Lincoln, NE 68588-0326
Telephone: 402-472-9307
Fax: 402-472-9311

Site(s): The materials are being used at sites across Nebraska. Copies of the materials have also been mailed to other Statewide Systemic Initiative offices.

Source: High Plains Consortium for Mathematics and Science

MAYO DEMONSTRATION SCHOOL OF SCIENCE AND TECHNOLOGY

Tulsa, OK

State-of-the-art development center provides an integrated curriculum with science focus for multi-age groupings of preschool through middle-grade students.

SUBJECT: Computer Science Education; Scientific Methodology; Mathematical Applications; Environment; Earth Science; Physical Sciences

TARGET AUDIENCE: Preschool-Grade 6 Educators; Culturally Diverse Classrooms

GENERAL DESCRIPTION

The Mayo Demonstration School of Science and Technology is both a science-focused elementary school and a professional development center for teachers and administrators. As a state-of-the-art educational laboratory representative of a geographically and racially diverse district, the Mayo School provides four- to ten-year old students a fully integrated curriculum emphasizing science and technology. Grade levels have been abolished, and multi-age groups of children work together on projects. Cooperative learning is emphasized throughout the school. Teachers function as empowering agents who help students "construct" learning for themselves. Staffing is non-traditional, with three lead teachers aided by nine "para-teachers."

Computing devices and computer-based learning strategies are an integral part of the program. Student portfolios are one basis for assessment, but extensive use is also made of the multi-subject diagnostic profiles generated by Jostens Integrated Learning System. The system maintains a multi-dimensional profile of each student's progress, time-on-task, and proficiency for each of the numerous subject matter modules that make up the program. A touchstone feature of the program is the student-led conference. Twice a year each student leads an individual conference with his/her teachers and parents. Using an ensemble of his/her work to illustrate competencies, strengths, weaknesses, and range of projects for the period, the student also sets goals for areas of concentration during the next nine-week period of study.

As a professional development center for teachers and administrators, Mayo provides teaching professionals with a "front-line laboratory" for emerging educational practices, technologies, and staffing interventions. All 77 Tulsa district sites send teachers to the center for training and observation on a weekly basis.

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Guides; Integrated Materials; Training Programs; Student Projects; Teacher Professional Development Materials; Calculators; CD-ROMs; Compact Disks (Audio); Computer Software; Data Files; Databases; Laserdiscs; Videodiscs; Videotapes	Computer Assisted Instruction; Cooperative Learning; Demonstrations; Discovery Learning; Experiments; Independent Study; Individualized Instruction; Interdisciplinary Approach; Multimedia Instruction; Problem Solving Approach; Self-Directed Groups; Thematic Approach; Language Teaching Approach	Criterion Referenced Tests; Holistic Evaluation; Performance Assessment; Portfolios; Scoring Rubrics	Critical Thinking; Divergent Thinking; Evaluative Thinking; Mathematical Literacy; Problem Solving; Productive Thinking; Science Process Skills; Scientific Literacy; Thinking Skills

Evaluation/Evidence of Effectiveness

Indicators used to determine effectiveness include student portfolios and student-led conferences, Jostens' Integrated Learning System, and teacher and administrator comments. Teacher training is evaluated through the use of questionnaires and reports from teachers and administrators of concepts being implemented in participants' classrooms. Participants report much greater motivation to attempt strategies after being able to see their implementation in the laboratory setting.

Resources/Materials needed for Implementation

Materials essential for replication include: a range of flexible furniture and fixtures for supporting a wide variety of learning styles; remote library access software; remote service center software; and access to a wide range of teaching software, manuals, and CD resources. Necessary human resources include: one curriculum manager, three to four curriculum specialists (one math, one science, one language arts, one social studies), four teacher trainers, three lead teachers, nine paraprofessionals, two teacher specialists (half-time) and one project director. Other resources essential for replicating the program include: (1) district administrator that actively supports site-based management and the sizable investment needed to start and sustain a "fusion" teaching lab/experimental school; (2) state regulatory waivers that permit hiring non-certified people for para-teaching positions; (3) a strong project manager; (4) a highly committed teaching core staff; and (5) ongoing computing/technological literacy support/training program for staff. The site may be accessed electronically. The address is mayo@vms.ocom.okstate.edu.

Cost

Materials range from $15,000 to 50,000; equipment ranges from $150,000 to $200,000.

Contact: Beverly Edwards
Project Coordinator
Mayo Demonstration School of Science and Technology
2525 South 101st. E. Ave
Tulsa, OK 74129-4420
Telephone: 918-621-6800
Fax: 918-621-6824

Site(s): Eugene Field Elementary, Tulsa, OK; Union Public Schools, Tulsa County, OK; Enid Public Schools, Enid, OK. In addition, several Mayo programs are being considered for statewide adoption by the Oklahoma Commission on Teacher Preparation.

Source: Southwest Consortium for the Improvement of Mathematics and Science Teaching

MICHIGAN SCIENCE EDUCATION RESOURCE PROJECT

Michigan Science Education Resources Project
Michigan Department of Education
Lansing, MI

K-10 activity oriented science units build around the conceptual change learning model.

SUBJECT: Biology; Chemistry; Physics; Weather

TARGET AUDIENCE: Grades K-10; At-Risk Students; Culturally Diverse Classrooms; Female Students

GENERAL DESCRIPTION

The Michigan Science Education Resource Project is a set of ten teaching units developed by the Michigan Department of Education which are designed to improve the scientific literacy of all students in grades K-10. The units are based on goals emphasizing comprehension more than content coverage, promoting useful and relevant learning, and supporting and encouraging students from groups traditionally underrepresented in science. While the units are primarily focused on topics in life science, physical science, and earth science, they "soften the boundaries between the disciplines" whenever possible. This is a platform of the AAAS Project 2061 report, *Science for All Americans*, from which the learning objectives for the units are derived.

All units have a teacher's guide and corresponding student materials for approximately six to eight weeks of activity-oriented sequenced lessons. The units are based on a conceptual change learning model in which students' conceptions about science topics are used as a basis for developing the curriculum and are key elements in the teaching strategies. Each unit is built around the learning cycle, beginning with key questions and following a development sequence that engages students in appropriate inquiry and builds students' scientific conceptions. Pre-assessments are used to help teachers understand students' perspectives and to start students thinking about the conceptual issues of the unit. Journals are used to record student data and answers to questions, providing a means for students to reflect back on their progress. Connections to students' everyday world are the primary contexts for each unit. Culturally-relevant readings and activities are used to support and encourage minority students. The units deal with the following topics: plants; food, energy, and growth; constructing toys and concepts; weather; and applications of chemistry.

Teachers have reported increased interest and engagement from their students, as well as much higher levels of student questioning. Teachers appreciate the strong content support provided in the materials. In workshops, the units generate healthy debate among teachers about the goal of "teaching less in order to teach it better."

(Year Initiated: 1990)

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Integrated Materials; Teaching Units; Units of Study; Teacher-Developed Materials; Teacher Workshops; Books; Photographs; Transparencies; Videotapes	Brainstorming; Cooperative Learning; Demonstrations; Discovery Learning; Experiments; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Multicultural Approach; Small Groups; Thematic Approach; Writing Across the Curriculum	Achievement Tests; Embedded Assessment; Interviews; Performance Assessment; Student Journals	Communicating; Conceptualizing; Critical Thinking; Experimenting; Logical Thinking; Observing; Predicting; Problem Solving; Reasoning; Scientific Literacy

Evaluation/Evidence of Effectiveness

Evaluation techniques used include criterion referenced tests, students' attitudes as reported by teachers, and teacher attitudes toward the usefulness and effectiveness of the materials. Student achievement data have been used primarily for improving the materials from field-test versions. State assessment data will be available in 1995.

Resources/Materials needed for Implementation

The units of study are needed to implement the program. No special human resources are required. Two or three day workshops to help teachers become oriented to the materials are useful, but not essential.

Support

Several science educators across Michigan are trained to do workshops and provide support in their region.

Cost

The cost for materials for each unit is less than $100 per classroom. There is a nominal cost for the units of study.

Contact: Theron Blakeslee
Project Director
Michigan Science Education Resources Project
Michigan Department of Education
P.O. Box 30008
Lansing, MI 48909
Telephone: 517-373-0454
Fax: 517-335-2473

Site(s): The program is used in several schools in Michigan.

Source: Midwest Consortium for Mathematics and Science Teaching

MINTS:

MUSEUM INQUIRY-BASED NATURAL HISTORY GUIDES FOR TEACHERS

Virginia Tech Museum of Natural History
Blacksburg, VA

Workshop and field guide aid teachers in using schoolyard as a natural history laboratory to teach inquiry-based science.

SUBJECT: Biological Sciences; Earth Science; Environmental Education; Physical Sciences; Geometric Concepts; Mathematical Applications; Science and Society

TARGET AUDIENCE: Grade K-12 Educators; All Students

GENERAL DESCRIPTION

The goal of the MINTS: Museum Inquiry-based Natural History Guides for Teachers program is to empower K-12 teachers to lead students in learning science. The program is based on the schoolyard—an outdoor laboratory that is available to all teachers and can be revisited whenever necessary. Instruction begins and builds on familiar objects and phenomena in the students' world.

The core of the project is the inquiry-based MINTS field guide to schoolyard natural history. The guide is written with minimal discipline-specific jargon for K-12 teachers to enable them to lead inquiry-based, hands-on explorations using the schoolyard as a laboratory. The guide highlights the plants, animals, and habitats that characterize the schoolyard. Unlike conventional and sometimes overwhelming field guides, the MINTS guide is organized by habitats—parking lot/sidewalk, lawn, walls and eaves, fence rows, and trees. The physical and biological features of each of these habitats are described, followed by questions and activities which teachers can use to engage students in exploration. Each habitat section also contains narrative and illustrations of the common plants and animals found there, making it easier for teachers to find and identify these organisms.

Teachers receive training on how to use the field guide in workshops offered by the Virginia Tech Museum of Natural History museum. Teachers learn science content information as well as how to use the guides to design their own inquiry lessons. The lessons engage students in using simple and inexpensive science tools to make observations, collect quantitative data, analyze data, make inferences and conclusions, and ask more questions. Teachers use guided inquiry techniques and open ended questioning practice to actively engage students. The two-day workshop, MINTS guide, a schoolyard, and some very inexpensive materials are all that are needed to implement this program.

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Manipulative Materials; Resource Units; Supplementary Materials; Teacher Professional Development Materials; Realia	Cooperative Learning; Experiments; Hands-on Learning; Problem Solving Approach; Self-Directed Groups	Alternative Assessment; Informal Assessment; Interviews	Conceptualizing; Critical Thinking; Decision Making; Graphing (mathematics); Problem Solving; Science Process Skills

Evaluation/Evidence of Effectiveness

Qualitative data, based on teacher feedback on effectiveness of the program, indicate teachers value the orientation workshop as a meaningful learning experience. Activities in classrooms are rated useful and effective. Teachers gained significant content understanding as a result of participation.

Resources/Materials needed for Implementation

A one-day workshop with follow-up technical assistance is recommended for replication. Materials necessary are background guides, investigative activity guides, and idea bank.

Support

Virginia Public Education Network (VaPEN), an Internet access point, is being used to promote communication between users.

Cost

Consult contact person for training costs. Materials are provided with training.

Contact: Dr. Susan Eriksson
Project Director
Virginia Tech Museum of Natural History
428 North Main St.
Blacksburg, VA 24061-0542
Telephone: 703-231-5360
Fax: 703-231-5446

Site(s): The program is based at the Virginia Tech Museum of Natural History, and used by more than 70 teachers from 14 schools in five counties.

Source: Eisenhower Math/Science Consortium at the Appalachia Educational Laboratory

National Engineering Design Challenge (NEDC)

Educational Information and Resource Center
Sewell, NJ

High school students work in teams using mathematics, science and technology to build a model to solve an engineering-based problem.

SUBJECT: Career Education; Engineering; Mathematical Applications; Physical Sciences; Robotics; Science and Society; Science Projects

TARGET AUDIENCE: Grade 9-12 Educators; At-Risk Students; Gifted/Honors Students

General Description

The National Engineering Design Challenge (NEDC) is a high school engineering-based program in which teams of students design, manufacture, and demonstrate models that solve a defined problem. NEDC challenges students to solve non-routine, societal problems by applying mathematics, science, and technology. The program was developed and is managed through the cooperative efforts of three organizations—Educational Information and Resource Center (EIRC), Sewell, NJ; National Society of Professional Engineers (NSPE), Alexandria, VA; and the Junior Engineering Technical Society (JETS), Alexandria, VA.

Past problems have included designing and fabricating solutions that replace a highway flag person at a construction site, turning document pages for a physically disabled person, retrieving and replacing objects that are out of reach, and opening and closing objects commonly found in the home or office. Each year, a single multidisciplinary problem addressing a societal need is prepared by a panel of engineers and educators. The participating high schools use this problem as the basis for special projects which result in an interdisciplinary course involving math, science, and technology. The key to the success of the program is using advising engineers and other resources in the community. The NEDC program has regional and state competitions and culminates in a national competition where students present, demonstrate, and defend both their development process and solution (working model) before a panel of experts.

(Year Initiated: 1989)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Group Projects; Reference Materials; Teacher Guides; Teacher Workshops; Models; Realia; Videotapes	Discovery Learning; Hands-on Learning; Interdisciplinary Approach; Problem Solving Approach; Small Groups	Group Assessment; Holistic Evaluation; Performance Assessment	Communicating; Creative Thinking; Decision Making; Evaluative Thinking; Formulating Models; Making Operational Definitions; Planning; Problem Solving; Productive Thinking; Spatial Ability; Visualizing

Evaluation/Evidence of Effectiveness

The key evaluative indicators are participation and problem solving success. At least 75% of the participating schools have been able to produce a product that either partially or completely satisfies the problem requirements. At least 50% of the teams include women and/or minorities. At least 85% of the teams provide evidence of using community resources, including engineers. At least 75% of the teams identify specific math/science concepts, facts, or calculations used to develop their product.

Resources/Materials needed for Implementation

It is recommended that schools intending to replicate the program provide a full day workshop including hands-on instructional modeling of program roles, team interaction, and sample problem solving activities. It is important to engage an advising engineer to work with the school as a resource person and mentor. The complete resource manuals for teachers, advising engineer, and state program coordinator describe materials necessary for replication, including a training video and the annual problem to be solved.

Support

The JETS national office in Alexandria, VA and EIRC in New Jersey have staff available to answer questions, conduct training, and provide other technical assistance. Also, assistance to local schools is available through state engineering societies, e.g., Delaware Society of Manufacturing Engineers, New Jersey Society of Professional Engineers, and colleges of engineering such as College of Engineering, Bucknell University.

Cost

Cost is $100 per school, including workshop.

Contact: Dr. Theodore J. Gourley
Associate Director
Educational Information and Resource Center
606 Delsea Drive
Sewell, NJ 08080
Telephone: 609-582-7000
Fax: 609-582-4206

Site(s): The program is currently being implemented in 200 high schools in 16 states. Three sites in New Jersey are: Morris Hills High School, Rockaway, NJ; Haddon Twp. High School, Westmont, NJ; Fair Lawn High School, Fair Lawn, NJ.

Source: Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education

NITTY-GRITTY, DOWN AND DIRTY SCIENCE CARNIVAL

English Estates Elementary School
Fern Park, FL

Science carnival of learning stations excites K-5 students about science.

SUBJECT: Elementary School Science; Science Experiments; Scientific Attitudes; Scientific Concepts

TARGET AUDIENCE: Grades K-5; Culturally Diverse Classrooms; Economically Disadvantaged Students; Suburban Students

GENERAL DESCRIPTION

The Nitty Gritty, Down and Dirty Science Carnival is a school-wide, hands-on learning event designed to excite K-5 students about science. At the two-day carnival, students engage in problem solving and inquiry-based activities, discover constructive learning, and experience hands-on investigations of their environment.

The carnival is held at the school media center and the adjoining outside ramp. Twelve learning stations are set up, and the children advance through a series of stations staffed by station masters, volunteers trained to assist and guide students from station to station based on a predetermined schedule.

Station activities appeal to interests ranging from kindergarten to fifth grade and are designed to take approximately ten minutes each. For example, a water discovery station equipped with funnels and tubes gives students the opportunity to experiment with water flow. At an electricity station, students experiment with open and closed circuits. In addition to assigned stations, the carnival also features stations such as "Manatee Awareness Station" and the "Dinosaur Dig Station" that children can visit at their leisure. All teachers are given a copy of the science carnival manual listing all experiments so they can prepare their students for the carnival and can easily implement the experiments in their classrooms following the carnival.

(Year Initiated: 1993)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Manuals; Program Descriptions	Discovery Learning; Experiments; Hands-on Learning; Kinesthetic Methods; Object Manipulation; Problem Solving Approach	Informal Assessment; Observation	Science Process Skills; Scientific Literacy

Evaluation/Evidence of Effectiveness

Much of the effectiveness of the Nitty Gritty, Down and Dirty Science Carnival is due to the dedicated volunteers who implement the program. At a previous carnival, more than 80 volunteers, including teachers, county office personnel, additional staff members, parents, senior citizens, local club members, and university students, volunteered more than 300 hours.

Educational indicators used to determine the effectiveness of the program included the following: (1) student and teacher enthusiasm for the project as indicated on post-carnival surveys; (2) lack of discipline problems during the carnival; (3) positive press coverage on local TV news and in area papers; and (4) other schools' requests for information. Post-carnival surveys indicated positive acceptance of the project. Faculty, staff, students, and community requested that the carnival be repeated.

Resources/Materials needed for Implementation

A core group of volunteers should be trained. The optimal ratio is one adult for each seven children. Materials needed for replication are those chosen for specific experiments.

Support

A 30-page carnival booklet that tells how to get started is available upon request. Contact Maureen Trimble. (See below.)

Cost

Cost of materials is about $1 per child.

Contact: Maureen Trimble
School Secretary
English Estates Elementary School
299 Oxford Dr.
Fern Park, FL 32730
Telephone: 407-831-1416
Fax: 407-831-6024

Site(s): English Estates Elementary School, Fern Park, FL

Source: SERVE Mathematics and Science Regional Consortium

'OHI'A PROJECT

Bernice Pauahi Bishop Museum and Moanalua Gardens Foundation
Honolulu, HI

Project increases teacher and student understanding of tropical ecology in the Hawaiian Islands.

SUBJECT: Biological Sciences; Ecology; Environmental Education; Geology; Natural Sciences

TARGET AUDIENCE: Grades K-8; Culturally Diverse Classrooms; Elementary and Middle School Teachers; Pacific Islanders; Student Teachers

GENERAL DESCRIPTION

The 'Ohi'a Project seeks to increase teacher and student understanding of the tropical ecology in the Hawaiian islands. The project materials are developed around four major themes—change, interdependence, cycles, and stewardship. Each of these themes is a strand that is woven through the disciplines of science, social studies, language arts, math, and art to comprise the project's framework. While the emphasis is on science, the interdisciplinary nature of the materials allows teachers and students to make connections among biological and earth sciences; to investigate ideas from ecological, cultural, and community perspectives; and to use basic skills from various disciplines as tools of discovery. The 'Ohi'a Project is named for the most common native forest tree in many Hawaiian ecosystems, the 'ohi'a lehua (Metrosideros polymorpha). Recognizing ecological kinship with other tropical areas and providing a conceptual framework for use in other parts of the world are secondary goals of the project.

The 'Ohi'a Project materials consist of guidebooks, color posters, videotapes, and a workshop manual. The 400-500 page guidebooks are for each of three grade levels—K-3, 4-6, and 7-8. Guidebooks are divided into main sections by grade level. Each group of grade level materials is divided into the following unit topics: geology, geography, plants and animals, humans and the environment (K-8), and global interactions (5-8). Each unit contains extensive background information, three to five lessons, and a list of resources. The student activities incorporate a variety of learning styles and emphasize a hands-on approach that fosters critical thinking and cooperative learning. Additional materials needed to support the project are commonly used arts, crafts, and science items.

(Year Initiated: 1987)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Guides; Enrichment Materials; Games; Integrated Materials Lesson Plans; Manipulative Materials; Reference Materials; Teaching Units; Visual Aids; Teacher Background Materials; Teacher Workshops; Interactive Video	Cooperative Learning; Demonstrations; Discovery Learning; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Multicultural Approach; Multimedia Instruction; Peer Tutoring; Problem Solving Approach; Self-Directed Groups; Thematic Approach	Formal Evaluation Informal Assessment; Interviews	Analyzing; Classifying; Collecting and Recording Data; Environmental Awareness; Interpreting Data; Observing; Predicting; Problem Solving; Science Process Skills; Thinking Skills

Evaluation/Evidence of Effectiveness

In a formative external evaluation of the guidebook drafts, teachers at the K-8 level document specific changes in student behaviors attributable to the project materials. Teachers estimated that about 90% of the target students had some level of success with the lessons. About 75% of grade 7-8 teachers indicated that student involvement was higher than in other lessons. K-3 children interviewed had an 80% success rate in answering cognitive questions about the lessons. Mean post-test score gains at grades 7-8 were statistically significant at the .01 level.

Resources/Materials needed for Implementation

Materials needed include: (1) curriculum guidebooks for each of the three groups—K-3, 4-6, 7-8; (2) 'Ohi'a Project videotapes—"We All Need the Forest" (grades 4-6), "In the Middle of the Sea" (grades 5-6), "Flowing to the Sea" (grades 3-7), and "CoastalZone" (grades 7-8); (3) 2 full-color posters; (4) 'Ohi'a Project Workshop Manual.

Support

Support includes: Tri-annual newsletter; distance learning interactive TV broadcasts linked to fourth grade lessons; field site training for teachers.

Cost

Guidebooks ($40.00 each); first two-videotape set ($6.00) from Bishop Museum; second and subsequent sets of videotapes from Moanalua Gardens Foundation ($12.95 a set); staff development session for 30 participants approximately $6,000-$8,000.

Contact: Maura O'Connor
Principal Writer/Editor
Moanalua Gardens Foundation
1352 Pineapple Place
Honolulu, HI 96819
Telephone: 808-839-5334
Fax: 808-839-3658

Site(s): Approximately one-third of the teachers at the K-8 level in Hawaii have been trained in the use of the 'Ohi'a Project materials and project database includes more than three thousand individuals and/or organizations who have received guidebooks.

Source: Pacific Mathematics and Science Regional Consortium

PARENT INVOLVEMENT THROUGH MATH, SCIENCE AND BEYOND

Solana Beach School District
Solana Beach, CA

Interactive hands-on math/science evening program engages K-6 students and their parent(s).

SUBJECT: Elementary School Science and Mathematics

TARGET AUDIENCE: Grades K-6; Bilingual Students; Hispanic American Students; Parents

GENERAL DESCRIPTION

Parent Involvement Through Math, Science, and Beyond is an interactive math/science evening program for K-6 students and their parents. Students and parents explore a variety of activities presented at evening family workshops. The hands-on learning experiences are continued and extended with a follow-up packet of activities for the families to enjoy together at home.

The 21 Math, Science, and Beyond units are designed and built upon themes such as those suggested in the California State Framework for Science and Project 2061's *Science for All Americans*. Examples of the activities included in the family workshop units are "Flubber," to explore the properties of solids and liquids; "Teetery Toothpick," to invent a way to balance a toothpick on the tip of a finger by lowering its center of gravity with wire; and "Blowing in the Wind," to discover how moving air affects air pressure. Two leaders at a school can implement the program.

Pre-packaged materials are available to conduct all workshops, excluding items not practical to ship. All student materials are written in both English and Spanish, and leader manuals describe necessary materials and how to conduct workshops.

(Year Initiated: 1989)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Bilingual Materials; Enrichment Materials; Integrated Materials; Manipulative Materials; Parent Materials; Kits	Cooperative Learning; Hands-on Learning; Interdisciplinary Approach	Alternative Assessment; Informal Assessment; Interviews; Performance Assessment; Surveys	Classifying; Comparing; Environmental Awareness; Identifying Attributes; Measuring; Observing; Predicting; Science Process Skills; Scientific Literacy

Evaluation/Evidence of Effectiveness

Groups of students and parents who participated in the project for a year were compared with similar groups from a neighboring school without the program. Students were individually assessed on the following science process skills: observing, sorting and classifying, and predicting and measuring. Each parent was videotaped working together with his or her child on a program activity. Changes in behavior and interaction were assessed. Additionally, each family evaluated every workshop using a pre/post questionnaire. An outside evaluator is scoring the alternative assessment information and viewing the family interaction videos.

Preliminary results showed substantial increases in students' and parents' interest in math and science, improvement in students' academic performance, and positive changes in parents' abilities and willingness to work with their students in math and science activities. During the workshops, families showed growth in knowledge and indicated enthusiasm for the activities in which they participated. They indicated eagerness to attend additional workshops. Most importantly, they indicated a new found interest and enjoyment in science.

Resources/Materials needed for Implementation

The manual for each workshop containing blackline masters for activity folders and at home packets is essential. Most of the materials used can be found at home or school. Workshop leaders can be teachers, parents, and community volunteers. High school and college students also successfully assisted in the workshops. Two leaders/facilitators and two to three other volunteers are essential for conducting a workshop and will need about six to eight hours preparation per workshop. The program can be implemented utilizing the information in the comprehensive manuals. In addition, a comprehensive one or two week training class is available to a school team.

Support

There are newsletters and follow-up "reunions" to share ideas. A network has been established that facilitates the users communicating with each other throughout the school year. Follow-up and new training is scheduled for the next two summers in Solana Beach, CA.

Cost

Each manual is $40. The average price of a complete purchased kit is $300; however, some units could be assembled for under $25 if teachers use home/school materials. Volunteers can be used for conducting lessons. Depending on the school's policy, teachers may receive stipends of $50 to coordinate each workshop.

Contact: Mary Cavanagh
Coordinator
Solana Beach School District
309 North Rios Ave.
Solana Beach, CA 92075
Telephone: 619-755-8980
Fax: 619-793-2536

Site(s): More than 25 elementary schools are using the program, including: Mission Burgener School, Oceanside, CA; Brooklyn School, San Diego, CA; Thomas O'Brien School, Albany, NY.

Source: Far West Regional Consortium for Science and Mathematics

PLANET X

Educational Information and Resource Center
Sewell, NJ

A hands-on program involving problem-solving activities related to an imaginary planet.

SUBJECT: Environment; Earth Science; Physical Sciences; Map Skills; Mathematical Applications; Science and Society; Science Experiments

TARGET AUDIENCE: Grade 7-9 Educators; All Students

GENERAL DESCRIPTION

Planet X is a hands-on, junior high math/science program involving problem solving activities related to an imaginary planet, Planet X. Its goal is to teach students to apply science knowledge and content to multiple disciplines and everyday life. Through a series of activities related to Planet X, students learn to see everyday problems as understandable and solvable through application of scientific thinking and rational problem solving. It is designed for students with a diverse range of abilities.

Planet X has three parts—Crew, Xchange, and XPODition. Crew training consists of classroom activities through which students learn to test samples of the atmosphere, hydrosphere, and lithosphere of Planet X and explore navigation systems. Xchange occurs after students form teams and are paired with two other teams from other schools to form a three-team pod. Pods are assigned a location on Planet X where they will reside at the XPODition. Communicating electronically or by letters with other teams, the POD builds a spheroscape representing their location. XPODition is the grand finale. Pods convene on Planet X (a gym or multipurpose room) to set up their spheroscape and then scientifically assess the safety of each region.

The program is easy to implement. Teachers do not need scientific expertise. Supporting resources include a teacher manual and a one-day staff development session which can be purchased from developers. Most teachers and students who participated in the 1993 program rated it as highly effective and expressed the desire to participate again

(Year Initiated: 1993)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Enrichment Materials; Group Projects; Program Descriptions; Training Programs; Teacher Guides; Charts; Diagrams; Maps; Measurement Tools; Mc ls; Photographs; Reatia	Cooperative Learning; Experiments; Field Trips; Hands-on Learning; Interdisciplinary Approach; Object Manipulation; Problem Solving Approach; Self-Directed Groups; Small Groups; Thematic Approach	Embedded Assessment; Situational Tests	Analyzing; Collecting and Recording Data; Communicating; Experimenting; Inferring; Interpreting Data; Planning; Problem Solving; Reasoning; Science Process Skills; Thinking Skills

Evaluation/Evidence of Effectiveness

At the conclusion of the final day's events, formal evaluations were administered to all teachers and students participating in the two field test sites (New Jersey and Maine) in April 1993. This evaluation consisted of separate questionnaires given to teachers and students. On a scale of zero to four, more than 70% of the teachers rated the program as three plus in the following categories: (1) meeting objectives in math, science, communication, thinking skills, teamwork, and decision making; (2) educationally worthwhile; (3) appropriate for age group; and (4) willing to do the program again. The majority of students met the criteria for success of planning, preparation, and execution of their projects.

Resources/Materials needed for Implementation

A complete teacher's manual, including worksheet and overhead masters, is provided to every participating site. A full day of training is necessary for teachers in hands-on modeling of program roles, laboratory and field skills, and team interaction.

Support

All participating educators receive ongoing support directly from the Educational Information and Resource Center (EIRC) by phone and periodic mailings. They may also contact Mike Hawkins, Space Science Group, Northwest State University, Natchitoches, LA 71497, 318-357-5186.

Cost

Cost for replication is $90 per school for manual and teacher training and $50 for consumable materials.

Contact: Dr. Theodore Gourley
Associate Director
Educational Information and Resource Center
606 Delsea Drive
Sewell, NJ 08080
Telephone: 609-582-7000
Fax: 609-582-4206

Site(s): More than 50 schools in Maine, New Jersey, and Louisiana, including St. Rose of Lima, Haddon Heights, NJ; New Egypt School, New Egypt, NJ; and Phillipsburg Middle School, Phillipsburg, NJ.

Source: Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education

PRIMARY SCHOOL SCIENCE LAB

Mason Heights Elementary School
Mason, OH

Science laboratory program for grades 1-3 provides developmentally appropriate, hands-on, inquiry approach to problem solving for interdisciplinary learning.

SUBJECT: General Science

TARGET AUDIENCE: Grade 1-3 Teachers; All Students

GENERAL DESCRIPTION

The goal of the Primary School Science Lab is to provide developmentally appropriate science activities and experiences as part of an integrated curriculum for primary students. Primary and special area teachers meet prior to and during the school year to discuss science lab lessons and to coordinate units of study. The science lab teacher acts as facilitator and coordinator. Each month, classroom teachers are given a list of proposed science lab lessons, so adjustments can be made to meet needs of students and teachers.

All primary students attend the academic hands-on science lab once a week as a special class. The lab lessons are researched and written to provide students with the opportunity to discover through active experience. The scientific inquiry method approach to problem solving is used, and each lesson has a hands-on activity to reinforce the scientific principle being taught. Studies include physical, chemical, biological, and earth sciences, and lessons are designed to reinforce the school's math and science curricula.

All classes are heterogeneous and include learning disabled and developmentally handicapped students. No text books are used; however, literature and topic-related books are displayed for student research and enjoyment. The science lab setting is a large room furnished with primary-size lab tables and chairs arranged in groups of four to facilitate cooperative learning groups. Eacl student keeps a journal or folder in which they make entries and keep experimental data. These remain in the science lab and are sent home periodically for students to share activities and knowledge with parents. Journals and folders are also used as evaluation tools. The science lab serves as a resource center for classroom teachers from which books, equipment, materials, and animals may be checked out for classroom use.

(Year Initiated: 1991)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Games; Lesson Plans; Manipulative Materials; Teacher Developed Materials; Charts; Picture Books; Posters; Transparencies	Cooperative Learning; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Multimedia Instruction; Peer Tutoring; Problem Solving Approach; Whole Language Teaching Approach	Informal Assessment; Interviews; Performance Assessment; Student Journals	Collecting and Recording Data; Environmental Awareness; Experimenting; Hypothesizing; Interpreting Data; Observing; Predicting; Problem Solving; Science Process Skills; Thinking Skills

Evaluation/Evidence of Effectiveness

Methods of evaluation include portfolios, journals, and surveys. Students are positive about recording in folders and journals and are eager to take their papers and journals home to share with parents. Students write enthusiastically about their favorite lessons, what they liked best about lab, and what they would change. The year end survey has been very positive, and students and teachers have responded with suggestions and topics to be included for the next year. The CTBS science scores show a marked improvement. For example, the average second grader's score improved more than eleven points between 1990 and 1993.

Resources/Materials needed for Implementation

Human resources needed to implement this program: a certified elementary teacher interested in science, math, and thinking skills who is willing to work with fellow teachers to integrate the science lab into the curriculum; supportive administrators and board of education; and courses and workshops that stress scientific inquiry, e.g. Project Discovery, The Ohio State University, Columbus, Ohio, and Terrific Science, Miami University, Oxford, Ohio. Most of the materials used in the science lab are provided by the parents and community. A "wish" list of common household products and inexpensive items is sent to parents in an introductory letter each year. Resource and reference books such as Janice Van Cleves' series ($10.95 each) and Robert W. Wood's series ($9.95 each) are used.

Support

Universities are very supportive, as well as science teachers' associations and state education associations such as the Science Education Council of Ohio and the Ohio Academy of Science.

Cost

(See Resources/Materials for Implementation)

Contact: Scott Inskeep (principal) and Bernice Stephenson (science lab teacher)
Mason Heights Elementary School
200 Northcrest
Mason, OH 45040
Telephone: 513-398-8866 or 513-398-5081

Site(s): Mason Heights Elementary School, Mason, OH

Source: Midwest Consortium for Mathematics and Science Teaching

PROBLEM SOLVING IN THE SCIENCES

UCLA School of Medicine
Department of Microbiology and Immunology
Los Angeles, CA

Software system allows construction of computer-based problem-solving experiences for middle to post-secondary grades.

SUBJECT: Scientific Concepts; Scientific Methodology

TARGET AUDIENCE: Grade 7-Post Secondary Educators; Culturally Diverse Classrooms; Curriculum Supervisors; English as a Second Language (ESL) Students; Female Students; Gifted/Honors Students; Limited English Proficiency (LEP) Students; Minority Students

GENERAL DESCRIPTION

Problem Solving in the Sciences is an innovative approach to improving and evaluating students' problem-solving skills across an interdisciplinary science curriculum. IMMEX (Interactive Multi-Media Exercises) is a Windows-based software system containing an authoring shell that allows the rapid construction of computer-based (IBM or PC) problem-solving experiences into which any subject or set of disciplines can be incorporated. The goals of the program are to: (1) improve the way science is taught in kindergarten through grade 12; (2) enable teachers to customize curriculum by using new technology in a meaningful way; (3) increase the ability of students to solve problems by using higher-order thinking skills; (4) improve the ability of teachers to evaluate students' problem-solving skills; (5) increase interest in science among women and minority students; and (6) bring university scientists and schools into a partnership that enables science teachers to access university resources in a way that will enrich the pre-college science curriculum.

The program involves students, teachers, principals, administrators, and educators of the Los Angeles Unified School District (LAUSD) and the Lennox School District; community and corporate leaders; and the faculty, students, and resources of the Science Education Partnership (SEP) of the UCLA School of Medicine. The project is comprehensive and systemic, providing continuity of content and process across the districts and throughout the middle and high schools. The IMMEX Project involves close collaboration among all participants to integrate career renewing opportunities for teachers with the production and delivery of materials that are scientifically accurate and that stress important ideas contained in the California State Science Framework.

The program provides an overall vehicle for broad-based change that focuses on students as active learners, involves curricula changes, restructures the concept of student evaluation, and may reduce tedious aspects of teachers' days. IMMEX problems have been created in many disciplines without the need for formal software programming—simply a demonstration and two-day workshop. Database features record students' use of the programs and provide a measure of student performance. More advanced software utilities electronically reconstruct individual student's or groups of students' performances, providing a unique cognitive perspective of their problem-solving strategies. Additional software tools seem to make the implementation and objective evaluation of students in this problem-solving format easier than more standard multiple choice questions. As an analysis tool, IMMEX provides insight into students' grasp of the concepts by examining the process by which they navigate through problems. IMMEX also complements hands-on experiences in the classroom.

(Year Initiated: 1986)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Assessment Materials; Group Projects; Simulation Software; Student Projects; Teacher Developed Materials; Computer Software; Databases	Computer Assisted Instruction; Cooperative Learning; Discovery Learning; Guided Design; Independent Study; Interdisciplinary Approach; Issues Oriented Science; Problem Solving Approach; Self-Directed Groups	Alternative Assessment; Embedded Assessment; Group Assessment; Performance Assessment	Critical Thinking; Formulating Models; Hypothesizing; Inferring; Interpreting Data; Problem Solving; Reasoning; Science Process Skills; Thinking Skills

Evaluation/Evidence of Effectiveness

IMMEX has been used as a tool for assessing medical students' problem-solving strategies for eight years at the UCLA School of Medicine and at more than 70 medical schools world-wide. At this time middle and high school science teachers are beginning to bring IMMEX problems into their classrooms. Evidence that shows the effectiveness of the program in the precollege classroom includes: (1) positive changes in students' attitudes toward science; (2) teacher interest and enthusiasm for a program that works for themselves and their students; (3) commitment by principals and assistant principals for their teachers to learn how to use IMMEX; and (4) endorsement for the IMMEX Program by the Principals' Educational Development Committee of the LAUSD Principals' Council.

Resources/Materials needed for Implementation

IMMEX training required for program implementation includes: (1) two-hour demonstration and discussion on development of exercises based on problem solving; (2) a two-day workshop; and (3) follow-up time for the teachers to complete problems and implement them in the classroom with continued support from the IMMEX staff. Materials needed include Windows software 3.1 or higher and IMMEX software and documentation. Teachers and school administration must be committed to making IMMEX work. Time for teachers to attend the demonstration and workshops and to complete the problems is essential. Approximately 40 hours per teacher are needed to create the first problem, after which new problems can take from less than one hour to four or five hours.

Support

IMMEX staff is available by phone to provide support. In the Los Angeles area, IMMEX staff may go to the school site. Teachers are also welcome to work in the IMMEX laboratory. An Internet server system is being developed to disseminate exercises.

Cost

Costs include: two-day teacher workshop - $200 per teacher; Windows software - approximately $50; IMMEX - no fee to member schools of the UCLA School of Medicine Science Education Partnership, estimated cost for others is $450; estimated cost for computer lab - $13,000.

Contact: Dr. Ron Stevens
UCLA School of Medicine
Department of Microbiology and Immunology
43-319 CHS
Los Angeles, CA 90024
Telephone: (310) 825-3456
Fax: (310) 206-3865
Internet Address:
rstevens@microimmun.medsch.ucla.edu

Site(s): 17 schools in Los Angeles Unified School District, CA; for example, Roosevelt High School, North Hollywood High School, and South Gate Middle School.

Source: Far West Regional Consortium for Science and Mathematics

PROJECT ABCD: ALTERNATIVE BLUEPRINT FOR CURRICULUM DEVELOPMENT

Texas Association for Supervision and Curriculum Development
Houston, TX

Flexible, interdisciplinary, electronic curriculum guide helps preschool-12 educators develop mathematics, science and social studies curricula.

SUBJECT: Elementary School Mathematics; Elementary School Science; Secondary School Mathematics; Scientific Concepts; Scientific Literacy, Content Area Writing; Technology; Social Sciences; Social Studies

TARGET AUDIENCE: Pre-K-12 Educators; Student Teachers

GENERAL DESCRIPTION

Project ABCD is an electronic curriculum guide containing fully developed curriculum for pre-kindergarten through 12th grade mathematics, science, and social studies. Each grade level and course in mathematics and science have fully developed objectives, and each objective is supported by a non-traditional assessment and a teaching activity. In addition, the curriculum contains interdisciplinary and real-world connections. These interdisciplinary connections, at every grade level and in every course, are activities that integrate mathematics and science concepts. Real world connections were developed from interviews with people in all types of careers and provide actual uses of mathematics and science concepts in the everyday world. This enables students to see the application of concepts they are learning.

Project ABCD aligns its curriculum with the Texas Essential Elements, the state-mandated testing program, the Scholastic Assessment Test (SAT), the American College Test (ACT), the NCTM Mathematics Standards, and the emerging science standards. In addition, all of the objectives at every grade level and course are correlated to Texas state-adopted resources.

Designed by teachers, the ABCD software allows districts and individual teachers to create their own local and/or personal versions of the curriculum through the use of three separate modes of operation, or "worlds." Users have the options of using only ABCD curriculum, adapting the ABCD curriculum, or creating additional curriculum incorporating their own resources. An individual teacher can modify a district curriculum to meet the needs of a particular classroom and individual students. Project ABCD also allows teachers to develop and print lesson plans.

(Year Initiated: 1991)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Assessment Materials; Curriculum Guides; Enrichment Materials; Group Projects; Integrated Materials Calculators; CD-interactive; CD-ROMs; Charts; Databases; Diagrams; Graphing Calculators; Laserdiscs; Maps	Brain-storming; Cooperative Learning; Discovery Learning; Experiments; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Object Manipulation; Oral Reports; Problem Solving Approach; Thematic Approach; Webbing; Writing Across the Curriculum	Alternative Assessment; Interviews; Performance Assessment; Scoring Rubrics; Student Journals	Communicating; Decision Making; Evaluative Thinking; Interpreting Data; Logical Thinking; Planning; Problem Solving; Reasoning; Thinking Skills

Evaluation/Evidence of Effectiveness

Informal surveys of consortium members indicate that teachers who have received training and have a support system, use the resources regularly, and many have now developed their total curriculum with the assistance of this program. Teachers who use the program indicate that they see positive effects on their students' conceptual understanding, level of participation, and enjoyment of mathematics and science classes. Interviews also indicate that students enjoy the activity-based instruction and look forward to mathematics and science classes. The integration of disciplines enables connections to be made throughout the school day and has resulted in increased student motivation and parental support of the approach.

Resources/Materials needed for Implementation

To replicate the program, it is necessary to have the ABCD compact disk and documentation manual with supplementary materials such as NCTM Standards publications. Teachers need six hours of training on how to use the program and time to work with it on a regular basis to fully utilize the components. A building or district level resource person provides support for teachers to become adept at utilizing all the capabilities for curriculum design and use.

Support

Telephone support, Tenet (Texas Education Network) electronic communication system, Newsletter, Area training sessions (no fee).

Cost

Includes computers - $1400 each; CD ROM drives - $300 each. Texas ASCD provides free regional training sessions for three to five trainers per district. Districts may request training for a fee of $750, plus expenses. Cost of materials: Mathematics Curriculum Pre-K-12 - $7,500; Science Curriculum Pre- K-12 - $7,500; documentation manuals - $50.

Contact: Bonnie Walker
Director of Special Projects
Texas Association for Supervision and Curriculum Development
16811 El Camino Real, Suite 124
Houston, TX 77058
Telephone: 713-286-3603
Fax: 713-286-4142
Internet Address: wandab@tenet.edu

Site(s): The program is being used in approximately 95 school districts in Texas and North Carolina: Killeen Independent School District, Killeen, TX; Port Arthur Independent School District, Port Arthur, TX; Robstown Independent School District, Robstown, TX.

Source. Southwest Consortium for the Improvement of Mathematics and Science Teaching

PROJECT PUMPKIN PATCH

Ray Elementary School
Hanover, NH

Program centered around growing pumpkins integrates math, science, and language arts into a direct learning experience for children five to seven.

SUBJECT: Elementary School Mathematics; Elementary School Science; Language Arts; Outdoor Activities; Plant Growth

TARGET AUDIENCE: Grades K-2; Rural Students; Suburban Students

GENERAL DESCRIPTION

Project Pumpkin Patch integrates mathematics, science and language arts into a direct, interactive learning experience that connects children, ages five to seven, to their environment. Children are involved in hands-on activities and tasks including: discovering and learning about good soil; researching seed companies; growing and transplanting seedlings; and caring for a garden. In the spirit of inquiry and constructivist learning, students and teachers work together.

Pumpkin Patch goes beyond the classroom to involve parents and community. Adult assistance is necessary to plow and initially prepare the area for planting. Parents then work hard to oversee and cultivate the garden. Having the site on school property permits close and constant observation and active involvement every month of the year. The integration of math and science through a year long learning experience features process learning that is developmentally appropriate while teaching a multitude of skills and concepts under the general theme of planting and harvesting. The garden size, crop type, and project complexity can be modified to fit the prevailing conditions and geographic location of other schools.

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Manipulative Materials; Books; Catalogs; Charts; Dictionaries; Filmstrips; Measurement Tools; Picture Books	Cooperative Learning; Discovery Learning; Hands on Learning; Informal Education; Interdisciplinary Approach; Journal Keeping; Small Groups; Thematic Approach; Whole Language Teaching Approach; Writing Across the Curriculum	Alternative Assessment; Group Assessment; Informal Assessment; Observation; Student Journals	Collecting and Recording Data; Environmental Awareness; Experimenting; Measuring; Observing; Planning; Predicting; Problem Solving; Science Process Skills

Evaluation/Evidence of Effectiveness

The following items were used to evaluate the success of the program: children's ability to describe what they know without coaching; ability to describe the sequence of events in planning, planting and harvesting 1200 pumpkins; ability to become "teacher leaders"; "time on task"; number of parent volunteers; and extent of peer tutoring. Pumpkins harvested provided enough money to repeat the project and pay all bills.

Resources/Materials needed for Implementation

Materials needed to replicate the project include seeds, potting soil, containers/pots and recyclable products. Human resources required are administrative and parental support and teachers knowledgeable in cooperative learning and integrated curriculum techniques. A sufficient lot of land and appropriate plan for the geographic region are also needed.

Support

A program video called, "Project Pumpkin Patch" provides additional support.

Cost

The cost for materials varies with class size.

Contact: Margaret Taylor or Sara DeMont
Ray Elementary School
Reservoir Road
Hanover, NH 03755
(Mail Inquiries Only)

Site(s): Ray Elementary School, Hanover, NH

Source: Eisenhower Regional Alliance for Mathematics and Science Education Reform

PROJECT SEED

Project SEED
Berkeley, CA

Socratic, group-discovery method prepares elementary inner-city students for advanced math.

SUBJECT: Mathematical Concepts; Mathematical Logic; Mathematics Skills

TARGET AUDIENCE: Grade 3-6 Teachers; At-Risk Students; Culturally Diverse Classrooms; Economically Disadvantaged Students; Limited English Proficiency (LEP) Students

GENERAL DESCRIPTION

Project SEED is a 30 year-old nonprofit organization in which mathematicians and scientists use a highly successful Socratic, group-discovery method to teach algebra and conceptual mathematics to students in inner-city elementary schools. The program supplements the regular mathematics program. The goals of the program are to: (1) improve mathematics achievement; (2) build academic confidence and self-esteem; (3) improve critical thinking, problem-solving, and communication skills; (4) increase the number of students from target schools who take advanced mathematics courses in secondary school; and (5) provide inservice for classroom teachers.

The Project Seed teaching method engages students in fast-paced, interactive dialogue which fosters high participation, conceptual understanding, and enthusiasm for mathematics. The Socratic, group-discovery method guides students by having them answer a series of questions through which they discover the principles or concepts involved. For example, using this method, fifth grade students discover laws for working with exponents. Project SEED instruction takes place in classes four periods a week for 14-18 weeks. Inservice training for classroom teachers is an integral component of the program. Ongoing staff development for the mathematics specialists includes peer observation, critiques, and workshops on mathematics, methodology, and curriculum. Inservice for classroom teachers in mathematics and methodology is based on observation of Project SEED lessons in conjunction with one-on-one discussions, workshops, and practice sessions.

(Year Initiated: 1963)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Frameworks; Curriculum Guides; Training Programs; Workshops; Teacher Workshops	Activities; Aural Learning; Debating; Discovery Learning; Discussion; Kinesthetic Methods; Problem Solving Approach	Criterion Referenced Tests; Embedded Assessment; Informal Assessment; Norm Referenced Tests; State Proficiency Tests	Abstract Reasoning; Communicating; Generalizing; Listening Skills; Predicting; Problem Solving; Recognizing Patterns; Thinking Skills; Using Equations

Evaluation/Evidence of Effectiveness

The following have been used to determine the effectiveness of Project SEED: (1) classroom observation; (2) feedback from classroom teachers and principals; (3) requests for Project SEED instruction; (4) scores on standardized mathematics tests; and (5) enrollment data for secondary school mathematics courses. Classroom observations indicate a high level of participation, enthusiasm, and understanding by Project SEED students. Requests for Project SEED instruction always exceed the amount of service available. Scores on standardized mathematics tests indicate that Project SEED students score higher than matched comparison students and that the differences are greater with each successive term of SEED instruction. Moreover, follow-up studies on students who have had three terms of Project SEED instruction show that former Project SEED students still score higher than their matched comparisons as long as five years after their last Project SEED instruction.

Resources/Materials needed for Implementation

Experienced Project SEED mathematics specialists with skills in management and training transfer the project to new districts by recruiting local mathematicians and training them to become mathematics specialists for the new program. Once they are assigned to classes, all mathematics specialists participate in three to four workshops per week for ongoing staff development, and they observe and critique their peers on a daily basis. No special materials are needed for replication, although there are internal guidelines on curriculum and methodology for the mathematics specialists who teach the classes.

Support

Includes meetings for project directors and leadership staff, intra-project visits, intra-project sharing of teaching guidelines, intra-project phone communication, and national staff.

Cost

The cost of Project SEED to a district depends on such factors as the size of the program, class size, and the local availability of mathematicians. The annual per student cost for direct instruction, curriculum development, teacher training, and staff development is $300-$400. There is no charge for SEED training.

Contact: Ms. Helen B. Smiler
National Projects Coordinator
Project SEED
2530 San Pablo Avenue, #K
Berkeley, CA 94702
Telephone: 510-644-3422
Fax: 510-644-0566

Site(s): Four northern California Districts and four cities outside California. Three current sites include the Dallas, Detroit, and Philadelphia School Districts.

Source: Far West Regional Consortium for Science and Mathematics

RIVERS CURRICULUM PROJECT

SIU Edwardsville
Edwardsville, IL

Activity-based program uses rivers to teach science, social studies, language arts, and mathematics to high school students.

SUBJECT: Environmental Education; Integrated Science; Mathematical Concepts

TARGET AUDIENCE: Grade 9-12 Educators; All Students

GENERAL DESCRIPTION

The Rivers Curriculum Project offers high school students and teachers the opportunity to engage in an activity-based program with real world implications for the environment. The project has crossed the boundaries of traditional curricular areas to unite science, social studies, and English. The river units have propelled a student force of "River Watchers" who research and monitor the rivers in their communities.

Seven units in the following areas have been developed: chemistry, biology, earth science, geography, language arts, mathematics, and Zebra Mussel Case Study. Each unit is designed to be a month long with each activity building on the previous one. Activities may also be used to supplement an existing curriculum. The curricular materials are interdisciplinary, incorporating elements of science, social studies, and language arts into each set of materials that focus on teaching data collection and interpretation. A computer telecommunications network is used to transmit and evaluate river data and writings for "Meanderings," the student-authored publication. A set of teaching materials has been developed that is applicable to any river. Once data are collected, they are used to solve problems and contribute to scientific and historical databases. Local, state and federal agencies use the data by accessing them via a telecommunications network and assessing the information. Teachers and students conduct workshops and give presentations for fellow "River Watch" interns, creating a network of interested, involved educators and young scientists whose ultimate goal is safe, clean rivers. Although scientific literacy is the main goal for developing a set of river materials, the major thrust is to communicate a clearer view of the nature and process of science and to actively involve students in environmental issues.

Teachers attend a one-week Rivers Curriculum Project Training Session during August. Each teacher chooses one unit for intensive training, such as biology applications of river testing, creating a database for test results, or language arts and basic science applications to a river. When they return to school, they either pilot or field test the curriculum depending on the developmental stage of that particular unit. After teaching the unit that includes an assessment package, their comments, suggestions, and student work are returned to the Project office where the writers incorporate comments. The project has grown from eight schools to almost 300 in four years.

(Year Initiated: 1990)

grade level

Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Guides; Resource Units; Teacher-Developed Materials; Teacher Guides; Calculators; Computer Software; Databases; Graphing Calculators; Maps	Cooperative Learning; Field Trips; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Thematic Approach; Whole Language Teaching Approach; Writing Across the Curriculum	Alternative Assessment; Observation; Performance Assessment; Portfolios; Student Journals	Collecting and Recording Data; Communicating; Environmental Awareness; Interpreting Data; Mathematical Literacy; Scientific Literacy

Evaluation/Evidence of Effectiveness

The following are used to evaluate the project: water quality data sent to the project office; "Meanderings" articles sent for publication; attendance at Student Congress; pre- and post-test of student attitude inventory; written student river study journals; field trips taken; guest lecturers; activities within the schools; presentations given outside school; and growth. Four "Meanderings" books were published for the 1992-1993 school year. Ninety-five presentations were given at the Third Annual Illinois Rivers Project Student Congress.

Resources/Materials needed for Implementation

A school district needs the units they wish to use along with the following materials: Water Quality Manual (Stapp and Mitchell) as a resource guide, relevant hand-outs for each of the three subject areas, and a copy of "Meanderings" software for the computer modem. A school and its teachers can become involved in the Rivers Project in three different ways: (1) a one-day training session conducted by two to three active Rivers Project teachers who travel to a school for an intensive day of science, social studies/English, and computer training; (2) a two-day training session in which several schools come together at a central location for in-depth training and teachers from a school stay together as a team, rotating through four one-hour sessions of science, social studies/English, computers, and grant writing with a general discussion during the last session on the second day; and (3) a one-week summer training session, in which a teacher chooses one area for extensive study with a workshop taught by writers of the curriculum units and university personnel. Teachers leave with $500 worth of equipment.

Support

An 800 number is in use for Illinois teachers three days a week; a regular telephone number is available 24 hours a day, seven days a week, year round; telecommunications system, (in addition, SOILED NET, INTERNET and FRED NET on-line resources are also used), and a newsletter is published four times a year. A student-authored book is published once a year.

Cost

Each curricular unit - $12, Meanderings - $12, Water Quality Manual - $10, Social Action for Kids -$15, software-free, 4 HACH kits - $288, triangular net - $15, kick nets - $15, modem - $80, Secchi disk - $10, Zebra Mussel device - $12. The cost for training and other options is calculated for each school.

Contact: Dr. Robert Williams, Director
SIU Edwardsville
Box 2222
Edwardsville, IL 62026
Telephone: 618-692-3788
Fax: 618-692-3359

Site(s): The project is used in 300 schools in 23 states: Chester High School, Chester, IL; East Peoria High School, East Peoria, IL; Streamwood High School, Streamwood, IL.

Source: Midwest Consortium for Mathematics and Science Teaching

SCIENCE IS FUN

The Ohio State University at Mansfield
Mansfield, OH

Hands-on, experimental science curriculum develops positive attitudes towards science by increasing teacher enthusiasm and competence.

SUBJECT: General and Physical Sciences

TARGET AUDIENCE: Grade 5-9 Teachers; All Students

GENERAL DESCRIPTION

Science is Fun is a program designed to introduce more hands-on, experimental science into the upper elementary and middle school curriculum. The long-range goals for students are to develop positive attitudes toward science and to master selected basic scientific concepts. The long-range goal for teachers is to develop enthusiasm for, and competence in, hands-on science. Science is Fun seeks to change the way science is usually taught. Teachers can learn both subject matter and a new way to teach it during the training sessions.

The program has three components: (1) a sequential compendium of hands-on exercises which can be used independently or in conjunction with an existing curriculum; (2) a comprehensive training format for teachers; and (3) a strategy for introducing the innovation into the school system. A partnership among university, high school, middle school, and elementary school staff sustains a commitment to hands-on science. Teachers attend a training session conducted by two experienced teachers. After they are introduced to the philosophy of the program, they perform and discuss each experiment, receive the written supporting materials and a representative set of equipment, and, in the process, develop a network of interested colleagues. In their own districts, they conduct a training workshop for their colleagues.

Science is Fun requires a minimum financial commitment. Each science concept in the program is investigated through an experiment performed by the students using simple everyday equipment and chemicals. Because students supply some of the materials, they develop a sense of ownership for the program. Easy access to materials allows students to perform the experiments themselves.

(Year Initiated: 1987)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Manipulative Materials; Teaching Units; Teacher Guides; Teacher Professional Development Materials; Teacher Workshops; Books; Measurement Tools	Cooperative Learning; Discovery Learning; Discussion; Experiments; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Object Manipulation; Problem Solving Approach; Small Groups	Alternative Assessment; Attitude Surveys; Informal Assessment; Portfolios; Student Journals	Estimating; Experimenting; Generalizing; Hypothesizing; Inferring; Observing; Predicting; Problem Solving; Science Process Skills; Thinking Skills

Evaluation/Evidence of Effectiveness

Science is Fun does not directly focus on student outcomes. It strives to change teacher attitudes, classroom behavior, and science teaching techniques. The training workshops have been evaluated by a questionnaire. A current grant is investigating teacher attitudes and classroom behavior before and after exposure to Science is Fun. Workshop evaluation data are consistently very positive. The strategy of teachers teaching teachers is welcomed as a positive change from the usual approach of an outside authority-dominated workshop. Teacher's guides written at an appropriate level for K-8 teachers with limited science background have been well received. Anecdotal student evidence and informal teacher feedback have indicated the success of the hands-on approach.

Resources/Materials needed for Implementation

Science is Fun Teacher's Guide along with everyday recycled materials and common purchased materials is needed for implementation. (A complete list of materials is in the Teacher's Guide.) One science-oriented teacher trained in the Science is Fun workshop can disseminate the program to his/her colleagues.

Support

Contact Janet Tarino.

Cost

Costs include: Fundamentals of Physical Science - $450/class of 30; Playground Physics - $350/class of 30.

Contact: Dr. Janet Tarino
Associate Professor, Chemistry
The Ohio State University at Mansfield
1680 University Drive
Mansfield, OH 44906
Telephone: 419-755-4342
Fax: 419-755-4327

Site(s): 36 school districts in 13 Ohio counties. Three districts implementing the program are: Columbus Public Schools, Columbus, OH (urban); Wooster Public Schools, Wooster, OH (suburban); Holmes County Schools, Millersburg, OH (rural).

Source: Midwest Consortium for Mathematics and Science Teaching

SCIENTISTS IN THE CLASSROOM

Pascagoula Schools Office
Pascagoula, MS

Volunteer science professionals from the local community teach scientific problem-solving methods to junior high students.

SUBJECT: Science Careers; Scientific Methodology; Science and Society; Technological Literacy

TARGET AUDIENCE: Grades 7-9; Scientists; All Students

GENERAL DESCRIPTION

The Scientists in the Classroom program uses volunteer science professionals from the local community to teach scientific methods of problem solving to junior high students. The goal is academic growth of students by using science and engineering problem solving skills as applied in the real world of work.

Volunteers receive informal training in teaching techniques from classroom teachers; then teach a class one hour a week for six weeks. They cover such topics as bridge design, ship building, paper making, and careers in science. During the seventh week of the course, they conduct a tour of a workplace. Under the direction of the industry instructors, students solve a work-related problem in much the same manner as done on the job. Instruction includes hands-on activities, discussion, critical thinking, observation of demonstrations, and written record keeping. Materials and equipment are provided jointly by the school (usually generic laboratory equipment and supplies) and industry partners (usually expendables and chemicals).

(Year Initiated: 1991)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Course Descriptions; Program Descriptions; Units of Study; Teacher Guides	Cooperative Learning; Experiments; Hands-on Learning; Issues Oriented Science; Problem Solving Approach; Small Groups; Thematic Approach	Informal Assessment; Tests	Communicating; Experimenting; Problem Solving; Critical Thinking

Evaluation/Evidence of Effectiveness

Assessments of students' knowledge, skills, and attitudes indicate that understanding of and interest in engineering and applied science are vastly improved by participation in this program.

Program effectiveness was determined by the following indicators: (1) scientist, teacher, and student feedback; (2) teacher responses to oral questions; (3) written student comments; (4) student content/skill mastery by evaluating log books and final written test; and (5) student attitude - assessed by questionnaire and informal interviews. The seven-week cooperative effort was determined to be a comfortable length. Industry partners find the program cost efficient. Student knowledge of science and engineering professions increased, their ability to describe a problem, propose solutions, and communicate findings improved, and their enthusiasm for science increased.

Resources/Materials needed for Implementation

Volunteer scientists are needed to teach a problem-solving curriculum one hour each week for seven weeks and creative teachers willing to integrate pure and applied science. Industry volunteers must be coached on pedagogy by the classroom teacher. Materials needed vary, depending on which module of the program is being presented. For example, the chemistry module requires non-hazardous chemicals for the students to use and other chemicals for demonstration purposes. The ship-building module requires art and building supplies.

Contact: Kathie Owens
Teacher Resource
Pascagoula Schools Office
Post Office Box 250
Pascagoula, MS 39568
Telephone: 601-938-6206
Fax: 601-938-6528

Site(s): Presently being implemented in six junior high schools in three districts in Jackson County, MS.

Source: SERVE Mathematics and Science Regional Consortium

SHERMAN'S LITTLE CITY PROJECT

Sherman Elementary School
Houston, TX

Elementary students learn mathematics in simulated life and job situations.

SUBJECT: Career Education; Mathematical Applications; Number Concepts

TARGET AUDIENCE: Grades K-6; At-Risk Students; Economically Disadvantaged Students; Minority Students; Parents; Remedial Students

GENERAL DESCRIPTION

Sherman's Little City Project was designed to provide opportunities for students to make economic decisions, take responsibility for those decisions, and analyze the results. It also provides opportunities for parents to support their children's education by participating in literacy and parenting programs and for the community to share the responsibility of educating future workers.

Sixth grade students apply for jobs at Sherman Elementary, interview with employers (Sherman faculty and staff), maintain work records, receive paychecks, conduct banking needs, and shop for items from the store. Students in other grades are able to earn "Sherbucks" through an incentive program for good behavior and attendance and may also make purchases from the store. Students learn mathematics in their classrooms that they apply in Little City. The interdisciplinary nature of the project allows students to experience the interconnections of the world.

The parental involvement component is composed of literacy classes and parenting programs held throughout the school year. The literacy program teaches parents the same language arts skills and mathematics problem-solving skills as their children. Parenting sessions model effective parenting skills that enable them to assist their children with academic and social growth in a positive, direct way. It is important to provide training for the parents, many of whom lack job-related skills.

The community aspect of Little City gives business and industry the opportunity to bring knowledge and expertise from the world of work into the classroom. Representatives from both public and private businesses become active participants in student learning through presentations and mentoring activities. These businesses also provide in-kind and monetary support for the operation of Little City.

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Learning Centers (classroom); Parent Materials; Program Descriptions; Simulations; Teacher Developed Materials; Calculators; Computer Software; Databases; DOS Software; Macintosh Software	Cooperative Learning; Field Trips; Hands-on Learning; Individual Instruction; Informal Education; Interdisciplinary Approach; Problem Solving Approach	Alternative Assessment; Attitude Surveys; Diagnostic Tests; Informal Assessment; Interviews; Multiple Choice Tests; Situational Tests	Communicating; Comparing; Computational Operations; Controlling and Manipulating Data; Decision Making; Estimating; Generalizing; Mathematical Literacy; Planning; Problem Solving; Using Decimals; Using Percentage

Evaluation/Evidence of Effectiveness

The indicators used to determine the effectiveness of the program were pre- and post-surveys, student and teacher interviews, student products, student attendance, and parent participation and support. Samples of student products showed positive changes in students' self-perception, confidence, and personal expectations, as well as improved communication and reasoning skills. Both formal and informal interviews were conducted with the employees of Little City, and teachers provided anecdotal records of student achievement.

The first quarter of the 1993-94 school year, school attendance increased from 94% to 98.4%. The integration of mathematics with real-world applications resulted in increased student motivation and parental support of the program.

Resources/Materials needed for Implementation

To begin the program the following are needed: (1) an inventory of items students are interested in purchasing (school supplies, toys, cameras, personal items, etc.); (2) a location to display inventory and conduct banking operations; and (3) a part-time coordinator to work approximately two hours per day, four days a week and four hours one day a week. Essentially, the coordinator is running a small business, and time and care must be invested for the operation to run smoothly. Prior business experience in personnel management, banking, or retailing would be helpful, but not required. Costs for coordinator depend on the individual chosen.

Support

Telephone support and site visits are offered.

Cost

The inventory costs approximately $15,000 per year, depending on the scope of the program.

Contact: Rosario Guerra Shellenberg
Sherman Elementary School
1909 McKee Street
Houston, TX 77009
Telephone: 713-227-3933
Fax: 713-227-3673

Site(s): Sherman Elementary School, Houston, TX

Source: Southwest Consortium for the Improvement of Mathematics and Science Teaching

SMALL SCALE SCIENCE: TEACHERS AS RESEARCHERS S³TAR

Center for Science, Mathematics and Technology Education, Colorado State University
College of Natural Sciences
Fort Collins, CO

Small-scale science approach provides inexpensive, safe and effective laboratory work for grades 5-9.

SUBJECT: Laboratory Experiments; Biological Sciences; Chemistry; Earth Science; General Science

TARGET AUDIENCE: Grade 5-9 Teachers; All Students

GENERAL DESCRIPTION

Small-Scale Science: Teachers as Researchers (S³TAR) empowers teachers of middle level science (grades 5-9) by giving them the necessary confidence and skill to employ small-scale science in the classroom. Small-scale science is an inquiry-based series of hands-on experiments using biomedical-plastic tools with drops of standard household chemicals in very dilute form. This method has been used successfully at Colorado State University, in many high schools nationwide, and in upper elementary, middle and junior high schools in Colorado.

The small-scale approach provides an innovative, inexpensive, safe, efficient, and effective way to get students involved in the excitement and promise of laboratory work. The small-scale approach uses non-traditional, plastic equipment originally developed for the fields of clinical chemistry, microbiology, and recombinant DNA research. The readily available equipment is strongly based on conservation principles, and its use requires only small amounts of materials and/or chemicals. The methods are applicable to most areas of science and allow for great sophistication in inquiry-based, hands-on scientific exploration. Most experiments can be conducted on a surface no bigger than 8 1/2" x 11". An example of student laboratory work with S³TAR is using drops of chemicals that change color in the presence of magnesium and/or calcium to test for water hardness.

Through their experiences in the S³TAR Institute, teachers learn to incorporate scientific, mathematical, and technological principles in an integrated manner within the framework of a thematic approach. They also acquire the ability to design original experiments and to make original discoveries. Teachers are given small-scale apparatus and equipment, ongoing inservice, mentoring, coaching, and mini-grants to help them incorporate the small-scale approach in their schools. Observations of workshops conducted by participants in their home districts have shown the S³TAR program does enable and inspire teachers to employ small-scale techniques.

(Year Initiated: 1991)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Programs; Manipulative Materials; Resource Units; Teacher Workshops; Kits; Measurement Tools	Cooperative I earning; Experiments; Hands-on Learning; Journal Keeping; Problem Solving Approach; Thematic Approach	Holistic Evaluation; Informal Assessment; Performance Assessment; Portfolios; Student Journals	Collecting and Recording Data; Conceptualizing; Critical Thinking; Experimenting; Interpreting Data; Problem Solving; Reasoning; Science Process Skills

Evaluation/Evidence of Effectiveness

Evidence of program effectiveness was gained through observations of workshops given by participants to their district colleagues. The workshops were evaluated by administrators, teachers, and students on site. Participant comments about the S³TAR workshop were also gathered through evaluation forms. The data gathered indicated that as a result of their participation in the S³TAR program, teachers are using small-scale equipment and techniques. In addition, the amount of laboratory work and student class participation has increased significantly.

Resources/Materials needed for Implementation

Educators interested in learning about small scale science should attend a S³TAR workshop at Colorado State University, or a consultant from the S³TAR program can provide on-site training. There is no prescribed program for the S³TAR workshop. Once someone has been trained in the small-scale approach, a teacher workshop can be designed to address the needs of teachers in a particular area.

Support

Ongoing support is available through the Center for Science, Mathematics and Technology Education at Colorado State University, the Center newsletter, and the mentor relationships established during the workshop.

Cost

The cost for a trainer is variable and includes travel costs and consultant fees. Equipment for a class of 30 is under $300.

Contact: Dr. Stephen Thompson, Director
Center for Science, Mathematics and Technology Education
Colorado State University
301 Natural and Environmental Science Bldg.
Fort Collins, CO 80523
Telephone: 303-491-1700
Fax: 303-491-6639

Site(s): Numerous locations in Colorado including: Durango, Montrose, and Limon school districts.

Source: High Plains Consortium for Mathematics and Science

S.M.A.R.T.

(SCIENTIFIC MATHEMATICAL ANALYSIS, REASONING, AND THINKING)

Mississippi School for Mathematics and Science
Columbus, MS

Integrated science, mathematics, and technology course prepares secondary students for problem solving and research.

SUBJECT: Laboratory Experiments; Mathematical Applications; Scientific Methodology; Secondary School Science; Secondary School Mathematics

TARGET AUDIENCE: Grades 9-12; All Students

GENERAL DESCRIPTION

S.M.A.R.T. (Scientific Mathematical Analysis, Reasoning, and Thinking) is an integrated science, mathematics, and technology course that prepares secondary students for problem solving and research in the real world. The goal of the program is to develop students' abilities to become skilled problem solvers who can formulate questions and communicate results.

S.M.A.R.T. develops problem solving and critical thinking through experimentation, data analysis, and verification of mathematical models. At the beginning of the course, the mathematics teacher lays the groundwork for problem solving and continually reinforces problem solving techniques. The science teacher briefs the students on experimental procedures to ensure accuracy and reliability. Students are introduced to a problem, and group discussion leads to problem definition. A group of three or four students designs a method to solve the problem. Although this could be a paper-and-pencil exercise, experimentation is usually the method of choice. The science teacher introduces appropriate science concepts at this point, employing discovery learning and questioning. In some cases, students build scientific models that can be used to verify the hypotheses or aid in the solution of the problem. The mathematics teacher identifies, clarifies, and reviews corresponding mathematics concepts that are essential to the problem and also introduces and explains the different types of technology students can use in analyzing data.

Teamwork is emphasized, with teachers modeling the process of creative problem solving rather than providing students with answers. Teachers also act as facilitators, helping students find possible solutions and determining which are most practical. Technical writing, interpretation of data, and genuine hypothesis development are incorporated.

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Program Descriptions; Teacher Developed Materials; Books; Calculators; Graphing Calculators	Brainstorming; Cooperative Learning; Discovery Learning; Discussion; Experiments; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Problem Solving Approach; Small Groups	Group Assessment; Scoring Rubrics; Tests	Analyzing; Communicating; Critical Thinking; Inferring; Interpreting Data; Logical Thinking; Making Operational Definitions; Problem Solving; Reasoning

Evaluation/Evidence of Effectiveness

Each student has a portfolio of formal reports, problem-solving exercises, and daily concept exercises. Student attitudes indicate the success of the program. A survey was conducted with former students to which 50% responded. All felt that the class had been beneficial to them. Current class evaluations indicate similar attitudes; 92% would recommend the course to others, and 100% enjoy the hands-on discovery approach.

Resources/Materials needed for Implementation

Basic training is needed to explain the overall philosophy and methodology of the course, and training in technology would be useful. Activities can be chosen from a wide variety of sources; therefore, there is a great deal of flexibility in resource materials used.

Cost

Cost is $200/day per trainer, plus expenses.

Contact: Claudia Carter
Mississippi School for Mathematics & Science
Box W-1627
Columbus, MS 39701
Telephone: 601-329-7360
Fax: 601-329-7205

Site(s): Mississippi School for Mathematics and Science, Columbus, MS

Source: SERVE Mathematics and Science Regional Consortium

S.O.S.

(SAVE OUR STUDENTS WITH SCIENCE)

Booneville Middle School
Booneville, MS

High school students learn practical ecology and environmental awareness while building an outdoor classroom on a nature trail.

SUBJECT: Environmental Education; Outdoor Education; Wildlife; Ecology

TARGET AUDIENCE: Grades 9-12; Rural Students

GENERAL DESCRIPTION

The goal of S.O.S. (Save Our Students with Science) is to teach practical ecology and to make students more aware of their environment and how they can protect our natural resources.

High school ecology classes collaborated with the school's tutors (students) to build an outdoor classroom on a nature trail on the high school campus. Students drew plans, purchased materials, and built the outdoor classroom which seats 30 students. They developed lesson plans that junior high school teachers can use to introduce their students to the nature trail and the outdoor classroom. In addition, trees along the nature trail were identified, solutions for erosion in wooded areas surrounding the trails were studied, bird houses were built, and wildlife tracks and trails were studied. Students were so interested in the project that another grant was written to continue hands-on learning projects.

A grant from the Southeastern Regional Vision for Education provided funding to expand the project. Students planted 300 shrubs and built three large flower beds on the high school campus. They helped a professional landscaper develop a plan for the school, measured and dug beds, prepared soil for planting, planted shrubs and flowers, and mulched plants. The community took pride in the projects and provided many free services to the students. After the planting, an awards picnic was held for all participants and their parents. Students will continue to plant flowers each season and care for the shrubs on a continuing basis—replacing dead shrubs, fertilizing, watering and pruning. Ongoing projects include composting leaves and recycling of cafeteria waste. New environmental projects will be added each semester.

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Parent Materials; Teacher Developed Materials; Realia	Cooperative Learning; Hands-on Learning; Independent Study; Individualized Instruction	Attitude Surveys; Informal Assessment; Interviews; Observation	Classifying; Collecting and Recording Data; Communicating; Critical Thinking; Decision Making; Environmental Awareness; Interpreting Data; Observing

Evaluation/Evidence of Effectiveness

Student attitude surveys, grade improvement, discipline referrals, and failure rate were used as program effectiveness indicators. An attitude survey, developed by the State Department of Service Learning, indicated that student attitudes became more positive about their school, community, and community service. Student grade improvement was indicated by final grade reports for second semester, 1993. Students who had presented discipline problems became school leaders and failure rates decreased.

Resources/Materials needed for Implementation

Materials required for the outdoor classroom include shrubs and flowers, and necessary building materials include lumber and nails.

Cost

Cost varies according to complexity of the project.

Contact: Linda Clifton
Principal
Booneville Middle School
100-A George Allen Drive
Booneville, MS 38829
Telephone: 601-728-5843

Site(s): Booneville Middle School, Booneville, MS

Source: SERVE Mathematics and Science Regional Consortium

SYSTEMIC INITIATIVE FOR MONTANA MATHEMATICS AND SCIENCE

Montana Council of Teachers of Mathematics
Montana State University
Bozeman, MT

University of Montana
Missoula, MT

Real world investigations improve skill and confidence in mathematics for high school students.

SUBJECT: Mathematical Applications; Technology; General Science; Functions (mathematics); Probability; Statistics; Content Area Writing

TARGET AUDIENCE: Grades 9-12; All Students and Teachers

GENERAL DESCRIPTION

The Systemic Initiative for the Montana Mathematics and Science (SIMMS) project was developed in response to the need for a paradigm that moves away from traditional practice, virtually void of applications, toward a practice rooted in real world investigations. Serving grades 9-12 mathematics students, it views mathematics as a constructive activity rather than as a set of facts or procedures.

The SIMMS project consists of six levels of an integrated mathematics curriculum embedded in science investigation. All students are expected to complete Levels 1 and 2 by graduation. College-bound students complete Levels 1, 2, and 4, and ideally Level 6. Levels 3and 5 are designed to meet the needs of students who learn at an alternative pace. Students at all ability levels are randomly chosen to participate in the Billings Senior High SIMMS program. A variety of instructional methods are used and include group and individual assignments; discussions with the teacher and among students; mathematical modeling; problem solving; project work; and guest speakers.

Assessment options include not only traditional testing, but also individual problems, group interaction, portfolios, research, journals, and projects. SIMMS materials undergo continuous revisions, initiated by classroom teachers using the materials. Examples of a few real world investigations used for applying mathematical functions are: (1) using a spreadsheet to organize data collected for making a decision about which car to purchase; (2) using insects to develop and understand a mathematical model for population growth; and (3) using Venn diagrams to organize data and compute probabilities related to the AIDS epidemic.

(Year Initiated: 1991)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Assessment Materials; Integrated Materials; Manipulative Materials; Resource Units; Simulations; Calculators; Computer Software; Diagrams; Dictionaries; Encyclopedias; Graphing Calculators; Macintosh Software; Measurement Tools; Programmable Calculators	Cooperative Learning; Discussion; Experiments; Interdisciplinary Approach; Multicultural Approach; Multimedia Instruction; Problem Solving Approach	Alternative Assessment; Holistic Evaluation; Informal Assessment; Performance Assessment; Portfolios; Student Journals	Abstract Reasoning; Collecting and Recording Data; Communicating; Decision Making; Environmental Awareness; Formulating Models; Generalizing; Graphing (mathematics); Interpreting Data; Mathematical Literacy; Problem Solving

Evaluation/Evidence of Effectiveness

One hundred percent of second-year SIMMS students at Billings Senior High School indicate an intention to elect a mathematics course for the following year. They display enthusiasm and express an interest in learning mathematics. Students are more willing to take risks and to express their ideas in class, and they have greater confidence in their math skills and overall self-confidence. After completing a SIMMS course, students are aware of the tremendous utility of mathematics. At the end of the first project year, SIMMS students and a group of non-participants were given an old SAT test, as well as an open-ended problem-solving test. No measurable difference was found on the SAT test, but the SIMMS students did much better on the problem-solving test.

Resources/Materials needed for Implementation

Teachers must be supportive of change. The students have not learned mathematics in this manner before, and it is a frustrating transition. Initially, the change involves a tremendous amount of work, but it soon can become exciting and rewarding. Classes in teaching the SIMMS project are needed and available through the University of Montana and Montana State University. Also needed are the SIMMS program books which can be obtained from the University.

Support

Educators involved with the SIMMS project are connected to the METNET educational telecommunications network in Montana. When questions arise, the teachers are able to send a message and receive prompt replies. The directors at Bozeman and Missoula are both readily available to answer any questions. SIMMS also has a newsletter and hosts a conference biannually. For teacher implementation strategies, contact Lisa Wood, Billings Senior High School, Billings, MT 59102, 406-255-3630.

Cost

Cost is $15 per student per year for course materials.

Contact: Dr. Maurice Burke
Co-Director for SIMMS Project
Montana State University
401 Linfield Hall
Bozeman, MT 59717
Phone: 406-944-5330

Site(s): The program is being used by over 100 schools throughout Montana, including: Billings Senior High School, Billings, MT; Flathead High School, Kalispell, MT; Glasgow High School, Glasgow MT.

Source: Northwest Consortium for Mathematics and Science Teaching

TEACHING SCIENCE CONCEPTS AND PRINCIPLES MADE EASY USING SCIENTIFIC DISCREPANT EVENTS

Kansas State University
Manhattan, KS

Teaching with counter-intuitive events motivates students in grades 4-12 to learn science.

SUBJECT: Biology; Chemistry; Earth Science; Physics; Secondary School Science

TARGET AUDIENCE: Grade 4-12 Teachers; Student Teachers

GENERAL DESCRIPTION

The main goal of Teaching Science Concepts and Principles Made Easy Using Scientific Discrepant Events is to provide teachers with a tool to stimulate curiosity and problem solving. The manual contains over 250 scientific discrepant events (actual outcomes or results are counter-intuitive and opposite of what are usually predicted by students) that can be used by teachers of earth science, physics, chemistry and biology to stimulate students' interest. The examples can also be used in upper elementary middle school, and high school. Each discrepant event is written as a hands-on investigation activity or minds-on exercise. The latter type, if modified by the teacher, can be used as an introduction or as a hands-on investigation. Use of the events is amenable to any instructional setting.

The instructional approach of the manual (Learning Cycle) is based on science education research. It is designed to help teachers meet research-based recommendations for teaching science concepts. The instructional approach engages students through curiosity. The dissonance created by unpredicted outcomes motivates students to question their environment. Materials necessary for implementing the program include the manual and simple equipment usually available in schools or within school budgets. For example, a biology experiment that shows how growth hormones in corn plants stimulate more growth when corn seeds are planted in the dark requires only soil, seeds, and planting containers. An activity that demonstrates the aerodynamics of airplane wing-lift requires only a piece of paper.

Workshops are designed to introduce teachers to the use of the discrepant events and provide them with experience using the Learning Cycle with cooperative learning. Teachers work in small groups to discuss ways for infusing the events into their classes. They are also given ideas for managing student behavior in creative ways when using a constructivist approach to teaching. One day training and one day follow-up sessions are usually sufficient to introduce teachers to the use of discrepant events. Teachers with strong science backgrounds may need no training. Anecdotal evidence from many teachers has indicated that the use of scientific discrepant events in a constructivist mode motivates students and stimulates their creativity and critical thinking.

(Year Initiated: 1989)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Resource Units; Science Projects; Teacher Professional Development Materials; Books	Cooperative Learning; Experiments; Hands-on Learning; Problem Solving Approach	Embedded Assessment; Informal Assessment; Observation; Performance Assessment	Conceptualizing; Controlling and Manipulating Data; Critical Thinking; Experimenting; Observing; Predicting; Problem Solving; Recognizing Patterns; Scientific Literacy

Evaluation/Evidence of Effectiveness

Evidence of effectiveness includes informal feedback from workshop participants and anecdotes from teachers using the discrepant events with their students. Most feedback has been very positive and indicates that teachers using the discrepant events with their students note improved attitude, creativity, and critical thinking.

Resources/Materials needed for Implementation

The only material necessary is the manual of discrepant events entitled "Teaching with Scientific Conceptual Discrepancies." The amount of training depends on teachers' backgrounds. One day training and one day follow-up, provided by a consultant from the University of Kansas, are usually sufficient.

Support

Teachers may contact Dr. Wright on Internet or by phone. A users' network may be established in the near future. E-mail address: birdhunt@ksuvm.ksu.edu.

Cost

Costs include: $300-$500 per day plus expenses for consultant to do training; $20 per class for equipment.

Contact: Dr. Emmett Wright
Kansas State University
237 Bluemont Hall
Manhattan, KS 66506-5310
Telephone: 913-532-7838
Fax: 913-532-7304

Contact: The materials are used at Southwest Missouri State University, the University of Alabama at Tuscaloosa in the science methods course, and by teachers at Colby Middle School in Colby, KS. Over 500 educators have purchased the manual.

Source: High Plains Consortium for Mathematics and Science

TECHNOLOGY OPTIMIZES PERFORMANCE IN SCIENCE

South San Francisco Unified School District
Skyline Elementary School
Daly City, CA

Project improves K-6 science instruction by matching technology and teaching methods to a sequenced curriculum framework.

SUBJECT: Elementary School Science; Technology

TARGET AUDIENCE: Grade K-6 Educators; Culturally Diverse Classrooms

GENERAL DESCRIPTION

The purpose of the TOPS (Technology Optimizes Performance in Science) project is to improve grades K-6 science instruction by systematically matching the most appropriate teaching methods and technology to a carefully sequenced curriculum framework. Optimum use is made of computers, instructional television, interactive videodisc, robotics, telecommunications, and hands-on science experiences. Teaching strategies emphasize the development of thinking skills and science processes as well as specific content. Staff development is designed to strengthen and reinforce the implementation phase of the state curriculum implementation cycle and provide experience and leadership for exemplary technological use.

The major goals of the project are to: (1) improve student achievement and knowledge in science; (2) develop students' critical thinking and problem-solving skills within the science curriculum; (3) stimulate student interest and motivation in science; and (4) demonstrate to teachers, through cooperative planning, modeling and coaching, the benefits of using technology and direct experience to support science instruction.

The Project Implementation Guide, which contains information on the selection, acquisition, and use of technology, is organized into the following seven booklets: (1) "Auditorium Shows," (2) "Special Events," (3) "Technology Lesson Plans," (4) "Learning to Use PSL in an Elementary School Setting," (5) "Creating Videos in the Classroom," (6) "Teacher's Resource Guide Database," and (7) "Awareness Packet." These documents are also available on a 3.5" disk format for the Macintosh using Microsoft Word, MacDraw, and SuperPaint.

Written materials are augmented by two videotapes designed for general audiences, teachers, and students: (1) "Project Overview" and (2) "At the Science Fair." Four videotapes are designed for teacher training: (1) "Video Camera," (2) "Videodisc Technology," (3) "Computer Peripherals," and (4) "Investigating with Probeware: PSL Applications in the Classroom." TOPS trainers can provide a variety of services to educators: (1) awareness presentations, (2) grant development/writing seminars, (3) on-site training sessions, and (4) workshops and consultation at adopting schools.

(Year Initiated: 1987)

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Lesson Plans; Science Projects; Teacher Professional Development Materials; Teacher Workshops; CD-ROMs; Computer Software; Interactive Video; Laserdiscs; Software; Probeware; Videodiscs;	Cooperative Learning; Demonstrations; Discovery Learning; Experiments; Hands-on Learning; Interdisciplinary Approach; Multimedia Instruction; Problem Solving Approach	Attitude Surveys; Field Tests; Needs Assessment; Performance Assessment; Surveys	Collecting and Recording Data; Communicating; Critical Thinking; Metacognition; Problem Solving; Science Process Skills; Scientific Literacy; Thinking Skills

Evaluation/Evidence of Effectiveness

The Comprehensive Tests of Basic Skills science subtest and the Test of Basic Process Skills in Science were used to assess student growth. Attitudes and interest were assessed with surveys, questionnaires, and interviews with students, staff, and parents. Improved achievement on science content and increased growth in knowledge and use of science process skills were indicated by the tests cited above. Teachers reported that student performance on individual/group projects indicated that students made substantial progress in understanding and applying science skills and concepts. Data from surveys, questionnaires, and interviews indicated that the project helped students develop skills and confidence using a variety of technologies. Observations have shown that teachers are facilitating interaction among students, and communication and collaboration among teachers have increased.

Resources/Materials needed for Implementation

An essential element in adopting Project TOPS is the staff development model provided to schools. Professional development provided by TOPS staff is designed to be flexible and adaptable to the varied needs of elementary schools. The curriculum goals of a site will determine its needs for staff development. The model supports in-depth training of a few individuals who then serve as trainers and models for a larger group of teachers or the whole staff. Visits to the Skyline school site and workshops and consultations with project staff are also available. Portions or aspects of TOPS can be acquired and adapted by any site regardless of its resources. A school may acquire videotape support materials to implement a school-wide activity that encourages active student participation and promotes student success in science.

Support

TOPS is part of a coalition of seven Level II Academic Model Technology (AMTEC) Programs funded by the California Department of Education. AMTEC provides a network of more than 300 schools statewide who share and support curriculum and technology programs. A newsletter to all sites is distributed twice a year and provides support for ongoing activities.

Cost

Costs include: on-site workshops - $30-$150; workshops at adoption site - $400; consultations at adopting site - $300; booklets - between $3 and $15 per booklet; videotapes - $15. Costs for equipment range from $500 to $33,000, depending on the needs, resources, and goals of the adopter.

Contact: Lyn Chan
Project Coordinator
South San Francisco Unified School District
Skyline Elementary School
55 Christen Avenue
Daly City, CA 94015
Telephone: 415-878-0176
Fax: 415-583-4717
Internet Address: lchan@ctp.org

Site(s): Adopted by fifty-four sites throughout California. Three examples are: Hollister School, Santa Barbara, CA; Country Club Elementary School, San Ramon, CA; Nakomis Elementary School, Ukiah, CA.

Source: Far West Regional Consortium for Science and Mathematics

VANDERBILT VIRTUAL SCHOOL

Vanderbilt University
Nashville, TN

Computer networking project provides teachers with training for, and access to, telecommunications resources.

SUBJECT: Elementary School Mathematics; Elementary School Science; Environmental Education; Mathematical Applications; Secondary School Mathematics; Secondary School Science; Statistics; Technological Literacy

TARGET AUDIENCE: K-Post-Secondary Educators; Adult Education Students; Culturally Diverse Classrooms; Economically Disadvantaged Students; English as a Second Language (ESL) Students; Minority Students; Student Teachers

GENERAL DESCRIPTION

The Vanderbilt Virtual School project was started in November 1991 to enable teachers to begin using computers and computer networks. The goal of the program is to provide educators in Tennessee with the opportunity to communicate with each other, share educational resources, have free access to the resources of the Internet, and ensure educators use of the resources available to them. The program has evolved into an electronic community with its own "virtual" population, infrastructure, communications network, and classrooms. The project has been developed and supported by volunteers, including university administrators, business leaders, and kindergarten through grade 12 professionals.

The Virtual School responds to the needs of educators to develop skills and gain access to computers and telecommunications resources through a community-wide effort which: (1) receives donated surplus personal computers from local business for teachers to use on loan; (2) utilizes experienced computer users as volunteers in initial training and support for teachers; (3) allows teachers to develop curricular ideas relevant to their own classroom needs, building on ideas generated by other teachers; and (4) provides teacher access to the Internet, connecting them to each other and millions of others in universities who have been using the Internet. By electronically linking teachers with their peers and providing training and technical support for using telecommunications resources, the Virtual School addresses the problems of teacher isolation and inadequate access to technology. More than 1,400 teachers at approximately 200 Tennessee schools have received training by more than 100 volunteers in using electronic mail, electronic conferencing, document archiving, and resources on the Internet.

The number of teachers using the Virtual School has increased each month. The Virtual School project is a set of strategies that can be applied in any community, and Vanderbilt seeks to build partnerships with other institutions willing to sponsor an electronic community among teachers in their area.

(Year Initiated: 1991)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Lesson Plans; Resource Units; Units of Study; User Manuals (Computers); Apple Software; Audiotapes; Calculators; CD-interactive; Data Files; Databases; Diagrams; Directories; DOS Software; Encyclopedias; Interactive Video; Laserdiscs; Maps; Windows Software	Aural Learning; Computer Managed Instruction; Cooperative Learning; Individual Instruction; Informal Education; Interdisciplinary Approach; Peer Tutoring; Problem Solving Approach	Informal Assessment; Participant Evaluation Questionnaires	Communicating; Problem Solving; Science Process Skills; Thinking Skills

Evaluation/Evidence of Effectiveness

The following indicators were used to assess the value of the program: participant evaluation questionnaires; level of participation; and formal and informal user feedback. The number of teachers using the Virtual School increased each month. As a result of their involvement with the project, a significant number of participants report decreased anxiety toward using computers and computer networks and increased capability in using the Virtual School in their classroom.

Resources/Materials needed for Implementation

To replicate the program the training manual is needed. A short orientation session is suggested.

Support

There is a "helpline" for teachers in Tennessee. For support outside Tennessee, call Susan Kuner at 615-343-6829.

Cost

Materials and training are free.

Contact: Susan Kuner
Vanderbilt University
405 Kirkland Hall
Nashville, TN 37240
Telephone: 615-343-6829
Fax: 615-343-0488

Site(s): Virtual School is based at Vanderbilt University, Nashville, TN with over 1,400 teachers participating across the state.

Source: Eisenhower Math/Science Consortium at the Appalachia Educational Laboratory

WESTMINSTER HIGH SCHOOL INTEGRATED SCIENCE PROGRAM

Westminster High School
Westminster, CA

Integrated high school science program coordinates concurrent teaching of physics, chemistry, biology, and earth/space science.

SUBJECT: Secondary School Science; Physics; Chemistry; Biology; Earth/Space Science

TARGET AUDIENCE: Grade 9-12 Educators; Culturally Diverse Classrooms; Minority Students

GENERAL DESCRIPTION

Integrated Science is a three-year program for high school students in which physics, chemistry, biology, and earth/space science are coordinated and taught concurrently. Connections are made through themes, and course work is team planned, taught, and assessed. Alternative assessments including performance tasks, portfolios, and open-ended test questions are used. The student population is culturaliy diverse. Students who stay in the program through the second year fulfill their graduation requirement of one year of physical science and one year of life science. Completion of the third year of the program satisfies recommendations for laboratory credit for the California college/university system. The program increases access for all students to the different fields of science through the development and implementation of an engaging curriculum that educates students in every science every year. It provides a model for the scope, sequence, and coordination reform of secondary science education promoted by the National Science Teachers Association (NSTA).

Content selection, format, and strategies were planned and written based on the following criteria: (1) recommendations of state and national documents, including: *Essential Changes in Secondary School Science: Scope, Sequence, and Coordination* (Aldridge, 1989); publications from AAAS' Project 2061; California University's recommendations for entering freshmen; and state frameworks; (2) age appropriate concepts; (3) students' interest and connections to the real world; and (4) science, technology, and societal issues. More than 40% of the program is hands-on, and laboratory- and activity-based.

Handouts, rather than books, are used to guide students through content and laboratory sessions in first and second year integrated science. Paul Hewitt's *Conceptual Physics* is used for part of third year integrated science. Most handouts give general guidelines for investigative laboratories, some explain content for homework reading assignments, and others present scenarios for the consideration of science, technology, and society issues. Most laboratory exercises and activities used in the three-year program have been compiled into a binder and are also on computer disks.

(Year Initiated: 1989)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Curriculum Frameworks; Integrated Materials; Student Projects; Teacher Developed Materials; Apple Software; Books; Laserdiscs; Macintosh Software; Probeware	Cooperative Learning; Discovery Learning; Hands-on Learning; Interdisciplinary Approach; Issues Oriented Science; Object Manipulation; Thematic Approach; Writing Across the Curriculum	Attitude Surveys; Embedded Assessment; Holistic Evaluation; Multiple Choice Tests; Performance Assessment	Classifying; Collecting and Recording Data; Communicating; Comparing; Creative Thinking; Formulating Models; Observing; Predicting; Problem Solving; Recognizing Patterns; Reinforcement

Evaluation/Evidence of Effectiveness

Evaluative indicators used include student surveys and examination of student records and materials. Students in the integrated science program achieve better grades as demonstrated by scores generated through holistic grading of performance tasks, portfolios, and open-ended test items. They pursue more advanced science courses than students in traditional classes. They have positive attitudes towards science and receive commendations on Golden State and California Learning Assessment System exams. The program has increased the number of students from the middle 50% who qualify for the university system in science by 400%. The program was one of three in the country to be honored with an extra commendation at the National Blue Ribbon ceremony at the White House in October 1993.

Resources/Materials needed for Implementation

Eight teachers are needed to cover the broad range of students in a large high school of approximately 4,000 students. It also takes the expertise and dedication of the state and local support people to implement a staff development program that brings teachers together at least once a month. The handouts used in place of a textbook are essential and are available in binder or computer disk form. Printed materials are evolving and are constantly revised, changed, and supplemented.

Support

Funding, training, classroom materials and a newsletter are provided by the California Scope, Sequence, and Coordination (SS&C) Project of the National Science Teachers Association (NSTA). SS&C nationally coordinates reform in secondary science and has a number of sites.

Cost

Copies of laboratory and other handout blackline masters cost $600. Cost of classroom materials for 21 classes is approximately $750 per year. If all equipment were newly purchased, it would cost more than $3,000.

Contact: Karen Carroll
Site Grant Coordinator
Westminster High School
14325 Goldenwest Street
Westminster, CA 92649
Telephone: 714-893-1381
Fax: 714-898-4721

Site(s): High Schools in Santa Ana, CA including: Bolsa Grande High School, Woodbridge High School and Santa Ana High School.

Source: Far West Regional Consortium for Science and Mathematics

WHOLE ECOSYSTEMS IN BALANCE (WEB)

Blue Mountains Natural Resources Institute Learning Center
La Grande, OR

Program gives students in grades 4-6 an extensive overview of ecosystem components and interactions.

SUBJECT: Elementary School Science; Ecology; Natural Sciences; Mathematical Applications; Conservation Education

TARGET AUDIENCE: Grades 4-6; Native American Students; Rural Students; Suburban Students

GENERAL DESCRIPTION

The Whole Ecosystems in Balance (WEB) program was developed to give students in grades 4-6 an extensive overview of ecosystem components and their interactions. The goal is to develop an awareness in students that the components are interconnected and must be viewed as a whole system, not just independent parts of the same system.

WEB consists of 12 classroom lessons and five field lessons for each grade level. Topics covered at each level include soil, water, plants, wildlife, resource uses, and management techniques. Behavioral objectives have been included for all lessons. The program was designed to build on itself and spiral through the grade levels. Lessons in each grade proceed along a continuum which develops more complex concepts and processes. A unique feature of WEB is the delivery method.

Most of the classroom lessons and all of the field lessons are taught by high school students who are first taught by teachers. foresters, biologists, entomologists, and other resource specialists. The contact between students and scientists and the exchange of first-hand knowledge are valuable features of WEB. In addition to learning the natural resource concepts, the older students gain experience in public speaking and in teaching. WEB also establishes an important link between elementary teachers and high school teachers. They communicate throughout the program about teaching materials, student evaluations, and schedules. The link established between teachers and scientists provides teachers with quality resource contacts.

(Year Initiated: 1992)

grade level Pre-k K 2 4 6 8 10 12 +

Instructional Materials Used	Instructional Methods Used	Assessment(s) Used	Intended Outcomes
Enrichment Materials; Games; Lesson Plans; Resource Units; Teacher Workshops; Charts; Diagrams; Maps	Cooperative Learning; Hands-on Learning; Interdisciplinary Approach; Journal Keeping; Peer Tutoring; Thematic Approach	Alternative Assessment; Informal Assessment; Interviews; Observation; Student Journals	Classifying; Collecting and Recording Data; Environmental Awareness; Inferring; Interpreting Data; Measuring; Observing; Predicting; Sampling; Science Process Skills

Evaluation/Evidence of Effectiveness

Elementary students involved in WEB consistently showed an eagerness to participate in both classroom and field lessons. Indications of their interest include few discipline problems, insightful questions, positive student comments, and focused attention during each activity. High school students who acted as teachers were surveyed and reported the same positive indicators. Student journals indicated high interest, content acquisition, and an eagerness to participate again. Elementary and high school teacher feedback was positive.

Resources/Materials needed for Implementation

The program requires a field trip site with access to a stream. Such sites are available on Forest Service land, campgrounds, state fish and wildlife lands, etc. Because high school students are trained by resource specialists, contacts with specialists are essential to replicate the program. Volunteer resource specialists can be recruited from agencies, industry, colleges, clubs, etc. Materials required include: pH paper, graph paper, meter sticks, trowels, and measuring tapes, most of which can be purchased from a department store.

Support

Oregon Ednet, PSInet provide additional information.

Cost

Materials and equipment costs are about $100.

Contact: Donna Rainboth
Natural Resources Specialist
Eastern Oregon State College
1410 L Avenue
La Grande, OR 97850
Telephone: 503-962-3720
Fax: 503-962-3701

Site(s): Union High School, Union, OR; South Baker Elementary School, Baker City, OR; Powder Valley School, North Powder, OR; Ukiah Schools, Ukiah, OR

Source: Northwest Consortium for Mathematics and Science Teaching

INDEXES FOR PROMISING PRACTICES 1995

PROMISING PRACTICES BY TITLE

PROMISING PRACTICES BY TOPIC

Elementary & Middle School Mathematics (Grades PreK-8)

Elementary & Middle School Science (Grades PreK-8)

Environmental Education (Grades PreK-12)

Multidisciplinary (Grades PreK-12)

Professional Development

Secondary Mathematics (Grades 9-12)

Secondary Science (Grades 9-12)

Technology-Centered (Grades K-12)

PROMISING PRACTICES IN MATHEMATICS AND SCIENCE EDUCATION 1994

PROMISING PRACTICES FROM THE REGIONAL EDUCATIONAL LABORATORIES-1994

The following annotated listing of promising practices emerged from a search conducted by the regional educational laboratories and appeared in *Promising Practices in Mathematics and Science Education* (1994). They are arranged in alphabetical order. To search for practices by topic see the index at the end of this section. Topics include: elementary mathematics, elementary science, middle-secondary mathematics, middle-secondary science, multidisciplinary, and technology-centered programs.

Algebra I/Physical Science Project (Grades 9-12)

An Integrated Mathematics / Science Program to Encourage Minority Students

Students in the Algebra I/Physical Science Project have the opportunity to integrate mathematics and science concepts and applications. A block schedule allows flexibility and attention to individual student needs. Career and field trips provide a career awareness feature. The program encourages minority students to take college prep mathematics, participate in goal setting, and recognize the importance of mathematics and science in career preparation.

Contact: Kit Peixotto, Northwest Regional Educational Laboratory, 101 SW Main Street, Suite 500, Portland, OR 97204-3212, 503-275-9500.

Arkansas Math Crusade (Grades 5-12)

Professional Development for Vertical Connections in Mathematics Instruction

The Arkansas Math Crusade, a fifteen module course, was developed based on the NCTM Curriculum and Evaluation Standards and the NCTM Professional Teaching Standards. The course, "Higher Order Thinking in Mathematics," is offered at eleven universities throughout the state. The materials incorporate manipulatives and calculators to create an active learning environment which is modeled and practiced with teachers in cooperative learning groups. During the course, teachers are expected to practice with their students the concepts and teaching strategies that have been modeled. Full implementation of manipulatives and an interactive student-centered style of instruction are the goal of the program.

Contact: Suzanne Mitchell, Program Director, 114 East Capitol Avenue, Little Rock, AR 72201, 501-324-9300; FAX: 501-324-9308.

BOCES Outdoor/Environmental Education Program (Grades K-12)

Cooperative Program Integrates Environmental Issues with Academic Subjects that Help Students Align Their Lives with the Natural World

BOCES III Outdoor/Environmental Education Program integrates environmental issues with academic subjects in an experiential learning approach. The O/EEP is comprehensive, enhances cooperative ventures with other agencies, and is consumer oriented. The programs range from a simple introduction to nature to mentored international research expeditions. Students formulate models, learn to use scientific equipment, relate findings to current knowledge, and draw conclusions. The primary goal is to improve academic learning for school-age children while helping preserve nature. The O/EEP uses the natural world in an interdisciplinary approach to teaching and prepares children to live responsibly with the Earth's natural systems.

Contact: Edward J. Zero, Program Administrator, BOCES III Outdoor/Environmental Education Program, Box 604, Smithtown, NY 11787 (Mail inquiries only).

Boston Public Schools Recycle Center (Grades K-12)

Center Provides Teachers with Free Materials for Hands-On Learning in Math and Science

The Recycle Center distributes material resources to teachers using hands-on approaches for quality mathematics and science education. The Recycle Center fosters unique business-education partnerships by donating unused by-products, overruns, and rejects for use in stimulating learning activities. The project's aim is to: (1) supply an ongoing flow of unique and stimulating materials free of charge to teachers; (2) provide inspiring professional development workshops focused on innovative instructional strategies; (3) promote business-school partnerships; (4) divert the flow of reusable materials from landfills and into the hands of teachers and children; (5) serve as a model for development of other Recycle Centers; and (6) promote an ethic of conservation and reuse of valuable materials.

Contact: Walter F. Drew, Ed.D., Founding Director, P.O. Box 1741, Institute for Self Active Education/National Schools Recycle Center Network, Boston, MA 02205, (Fax or Mail inquiries only) FAX: 407-984-1018.

C²PC-Computers/Calculators Pre-Calculus (Grades 9-12)

Promoting Student Success in Pre-Calculus through Instructional Technology

The C²PC program is built around a model in which the students and teacher use hand-held graphing calculators and an overhead projector version of a graphing calculator to become active participants in mathematics activities. The goals of the program are to provide equal access to mathematical power for all students, to encourage students to continue mathematics and science study, and to adequately prepare students for advanced courses at the college level. The objectives of C²PC are: (1) to allow students to develop concepts about graphs and functions through interactive and user-friendly technologies; (2) to stimulate student investigation of real-world problems; and (3) to provide mathematical topics and experiences that foreshadow the study of calculus.

Contact: Dr. Tommy Eads, Math Teacher/Technology Coordinator, 3201 Lewis Lane, Paris, TX 75460, 903-737-2020; FAX: 903-737-2008.

Calculator Mathematics Curriculum for Grades 6-8 (Grades 6-8)

Instructional Strategies and Calculator Curriculum for Middle School Mathematics

The University of Houston/Alief ISD project is the result of a collaborative effort between a large metropolitan university and a local intermediate school district to improve mathematical instruction in grades 6-8. The use of calculators is the central focus in the curriculum. Most of the activities are for small working groups or pairs of students in order to increase student involvement and communication of their mathematical findings. Teacher notes provide questions for large group summary discussions of problem-solving strategies and/or approaches. The practice intends to: (1) explore ways in which calculators could best be used for instruction and student exploration in the middle grades; and (2) create model calculator curriculum materials for grades 6-8.

Contact: Juanita Copley and Hersholt Waxman, Co-Principal Investigators, University of Houston, College of Education, Curriculum & Instruction Department, Houston, TX 77204-5872, 713-743-4949; FAX: 713-743-9870.

Center for Improved Engineering and Science Education (Grades 7-12)

School-College Collaboration for Educational Improvement through Technology

The Center for Improved Engineering and Science Education (CIESE) works with school districts to create programs with focus on teacher-directed computer use in mathematics instruction. The goal of the program is to promote the use of computers to develop and provide innovative and effective curricula and instructional strategies for math teachers, and to improve math, specifically in grades 7-12, by providing opportunities to enhance learning by integrating technology into the mathematics classroom.

Contact: Angelina Saraceno-Corbet, Consultant, Stevens Institute of Technology CIESE, Hoboken, NJ 07030 201-216-5037.

College Preparatory Mathematics Program (Grades 9-12)

A Cooperative Learning Mathematics Program Developed through School-University Collaborations

The program is a university/high school collaboration that helps potentially successful, but under-represented (minority and female) and at-risk students to succeed in precollege mathematics. The primary goal is to establish and maintain an environment that encourages under-represented and at-risk students to enroll and succeed in precollege mathematics.

Contact: Barbara Sandall, North Central Regional Educational Laboratory, 1900 Spring Rd., Suite 300, Oak Brook, IL 60521, 708-571-4700.

A Constructivist Mathematics Program (Grades K-5)

Elementary Math Program in Which Students Learn Underlying Principles of Mathematics for Themselves

This elementary math program is based upon constructivist learning theory in that students discover the underlying principles of mathematics for themselves. Students learn to do their own thinking, develop confidence in their ability to figure things out, come to believe that math is logical, and s k truth through exchange of viewpoints.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-?950, 904-922-8533; 800-854-0476; FAX: 904-922-8068.

Cross Curricular Multi-Ability Integration of Environmental Education (Grades 6-8)

Multi-Age, Multi-Ability Hands-On Environmental Science

The program integrates students from multi-grades and multi-abilities into cooperative teams to conduct field work, complete a variety of classroom tasks, and develop products in the areas of environmental education. The program's two main goals are to provide students with the understanding that they are stewards of the environment and to foster a sense of respect and value for all team members.

Contact: Midge Yergen, Science Teacher/Dept. Chair, Selah Middle School, 411 North 1st Street, Selah, WA 98942 (Mail inquiries only).

Developmental Approaches in Science and Health (DASH) (Grades K-6)

DASH: A K-6 Developmental Approaches in Science and Health Program

The K-6 DASH program (developed at the University of Hawaii) integrates learning in science, health, and technology, facilitating the use of skills and knowledge of science, health, and technology in both a personal and social context. DASH goals are to develop a commitment to care and nurture our environment and the human community.

Contact: Francis M. Pottenger, Professor of Education, 1776 University Avenue, UHS 2-202, Honolulu, HI 96822, 808-956-6918; FAX: 808-956-9486.

Elementary Math Lead Teacher (Grades K-6)

A Math Staff Development Program Involving Graduate Credit Courses

The Elementary Math Lead Teacher Program is a staff development model that improves mathematics instruction in the elementary school. The program goal is to improve mathematics education for all elementary school students, including special needs students.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476; FAX: 904-922-8068.

Environmental Science Seminar Classes "Monday Groups" (Grades 11-12)

A High School Based Environmental Science Course

The program is an environmental science research class for high school juniors and seniors. It improves students' knowledge and understanding of science by engaging them in "action research" and service projects in the community. The class objective is that each student positively contributes to the chosen action research project for the year. Students are expected to demonstrate mastery of a set of core skills and basic knowledge as they contribute to the effort. They are also expected to communicate what they have learned and how they feel about their own and the classes ability to solve problems.

Contact: SERVE Consortium for Mathematics and Science Education, 325 South Magnolia Drive, Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476, FAX: 904-922-8068.

Family Math & Matemática para La Familia (Grades K-8)

K-8 Mathematics Program Promotes Family Involvement by Removing Language and Cultural Barriers

Family Math (FM) and Matematica Para la Familia (MPF) transform student attitudes towards mathematics and empower parents by giving them a new sense of confidence. They open lines of communication within families and between home and school. FM/MPF programs seek to involve families in their children's mathematics education in a positive and effective way. They focus on specific populations (e.g., Spanish speaking) and help the student and adult family member develop greater self-confidence as they perceive themselves able to think mathematically. They raise the awareness that mathematics is important to study.

Contact: Mary Jo Cittadino, Network Coordinator, EQUALS/Family Math/IMP, Lawrence Hall of Science, University of California, Berkeley, CA 94720, 510-642-0738; FAX: 510-643-5757.

Foundational Approaches in Science Teaching (FAST) (Grades 6-10)

FAST: A Hands-On Interdisciplinary, Environmental Science Program

The FAST program is an interdisciplinary, environmental science program which emphasizes basic concepts and methods of the physical, biological, and earth sciences and relates these to the practical issues of human use of the environment. FAST is designed for students in grades 6- 10. FAST assumes that every child builds a unique understanding of the world which is normalized through teaching; that in science and technology a successful path to normalization is found in reliving the generation of seminal ideas, techniques, and inventions; and that the content and inquiry reflect the nature of the disciplines and technologies being studied.

Contact: Donald B. Young, Associate Professor, 1776 University Avenue, CM117 Honolulu, HI 96822, 808-956-7863; FAX: 808-956-9486.

The Geometric Supposer Series

Software Program Fosters Experimentation, Inductive Reasoning, and Conjecturing Among Geometry Students

The Geometric Supposer is a series of software programs designed to introduce experimentation, inductive reasoning, and conjecturing into the learning of geometry in secondary schools. The series consists of four programs. Three deal with a family of geometric shapes, triangles, quadrilaterals, and circles, and allow users to create on the computer screen any construction that can be carried out with a straight edge and compass. The fourth program, the preSupposer, introduces younger students to geometric shapes, constructions, and definitions. The software also includes supporting procedures where users can measure any element in the construction. They can add, subtract, multiply, divide, or square those measurements. They can rescale and can return to previous shapes with the same or different constructions. The software allows users to repeat constructions as procedures on other shapes. The Supposer's objective is to enable

students to explore the properties of shapes and geometric elements. They can also investigate whether the properties and consequences of a given construction on a given shape are dependent on some particular property of that shape, or whether the result can be generalized.

Contact: Sunburst/Wings for Learning, Inc. 101 Castleton Street, Pleasantville, NY 10570, 800-321-7511.

Hands-On Environment (Grades K-4)

Primary Grades Environmental Studies Program Using Outdoor Lab

The school is the focus for a science-oriented curriculum. "Environment" is the main theme around which nine thematic units were developed. The units are the framework for a totally integrated program with science as the central unifying discipline. The instructional strategies are grounded in Howard Gardner's seven multiple intelligences. Learning is relevant to the real world and assessment is authentic. The primary goal of the Hands-On Environment Program is to help each child learn the skills, knowledge, and attitudes needed to be a responsible caretaker of the environment while linking education to the world and fostering a lifelong desire for learning.

Contact: Betty Fox, Teacher, Albert Benjamin Chandler Elementary, 11215 US Hwy. 60, W. Corydon, KY 42406.

Harbor Explorations (Grades 4- 12)

Harbor Explorations and Classroom Activities Foster Environmental and Marine Education

Harbor Explorations promotes active environmental marine education through classroom and vessel-based learning experiences. Students and teachers come to the project's research vessel, the Envirolab, to perform experiments using technologically sophisticated equipment. In the classroom, Harbor Exploration staff continue to work with teachers and students to integrate the program across the curriculum as well as within the fields of chemistry, biology, and physics. Staff also set up learning opportunities between mentor teachers, student teachers, and students. Teachers are supported by a summer institute, the annual harbor Educators Conference and several publications. The project provides an institutional base where teachers can improve their knowledge, skills, and research abilities using the marine environment to motivate active, on-the-water student experiences that will become a part of the classroom curriculum.

Contact: Mike Borek, Director, Harbor Explorations, University of Massachusetts-Boston, Graduate College of Education, I.L.T., Boston, MA 02125 (Mail inquiries only).

The Hawaii Algebra Learning Project (Grades 7-12)

Algebra I: A Process Approach

The Hawaii Algebra Learning Project fosters the development of problem-solving processes through the sequencing of algebraic problem tasks. Class time is spent developing the why and how of algebra. This strategy is driven partly by the problems themselves and partly by the pedagogy. The problem contexts encourage students to explore and investigate the uniqueness of answers and the variety of solution paths. The pedagogy is student-centered, with students and teacher sharing ideas. The goals of the Hawaii Algebra Learning Project are to: (1) develop problem-solving processes; (2) provide open-ended inquiry appropriate for individual differences; (3) introduce concepts through problem situations; (4) encourage the development of understanding of concepts and generalizations; and (5) reinforce skills over time.

Contact: Annette Matsumoto or Lani Abrigana, Math Dept. Chairperson, University Laboratory School, 1776 University Avenue, Honolulu, HI 96822, 808-956-4988 or 808-956-6216; FAX: 808-956-4984.

Hawaii Marine Science Studies (HMSS) (Grades 9-12)

HMSS: A Marine-Based Science and Technology Program

The HMSS is a one-year multidisciplinary science course set in a marine context for students in grades 9-12. There are two companion student books in the program: The Fluid Earth and The Living Ocean. The Fluid Earth explores the physics, chemistry, and geology of the oceans and their applications in ocean engineering and related technologies. The Living Ocean explores the biology and ecology of the oceans and other aquatic environments and their application in aquaculture and related technologies. The goals of marine education are to develop awareness, knowledge, and understanding of the ocean's relationship to the total environment and the ocean's particular influence on humankind and society. Of key importance is the development of a commitment to the wise use of the oceans and all other environments.

Con act: Francis M. Pottenger, Professor of Education, 1776 University Avenue, UHS 2-202, Honolulu, HI 96822, 808-956-6918; FAX: 808-956-9486.

The Hayes Cooper Center for Math, Science, and Technology (Grades K-6)

An Elementary Magnet School with Special Emphasis on Math and Science

The Hayes Cooper Center is an elementary magnet school in Merigold, Mississippi, with special emphasis on math and science. Goals expand upon the aim that every student will progress academically every day. The Center brings together students of different social, economic, racial, and ethnic backgrounds. It provides an educational setting that measures success in national and international terms rather than shooting for the state's mean. The Center seeks to eliminate minority isolation in the Cleveland community at the elementary school level by maintaining a 50/50 racial composition. Cultural diversity is celebrated as the individual's unique background, interests, goals, and desires are emphasized.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533, 800-854-0476; FAX: 904-922-8068.

High School Students Teach Neat, Wow Science (Grades K-5)

High School Students Teach Science in Elementary Schools

NEAT-WOW involves highly motivated high school students in the teaching of elementary school science. Two students involved in NEAT-WOW have since graduated from college and have become teachers themselves. The program objective is to provide opportunities for elementary children to explore physical science concepts in a safe, supportive, hands-on environment.

Contact: Ron Perkins, Greenwich High School, 10 Hillside Road, Greenwich, CT 06830, FAX: 203-656-3441.

The Institute for Science and Mathematics (ISM) (Grades 9-12)

Increasing Student Awareness of Science and Mathematics Through Experiential Learning

The ISM challenges students through a continuous-study core curriculum. ISM students enroll in an introductory common course which also functions as an advisory class in the transition to high school. The goals of the ISM are to excite student interest in mathematics and science; to increase minority and female student enrollment in the mathematics and science courses; and to develop students' potential to meet the changing demands of higher education, business, and industry.

Contact: Fred Rectanus, Program Coordir ator, Grant High School, 2245 N.E. 36th Avenue, Portland, OR 97212 (Mail ir quiries only).

Integrating Technology into Elementary Math & Science (InTech) (Grades K-6)

Trainers Workshop in Integrating Math, Science, and Technology in Elementary Schools

The InTech program is a "train-the-trainer" model that prepares science and technology specialists to assist teachers in more effectively using technology in elementary math and science instruction. The program consists of a Trainer's Resource Guide and an InTech Institute. The Resource Guide contains step-by-step instructions and teacher enhancement activities to conduct of five teacher inservice workshops on the use of simulation software, optical technologies, probeware, and database technology in the classroom. Prospective trainers participate in a three day "InTech Institute" where the InTech workshops are modeled. Its goals are to help districts provide effective inservice in the integration of technology in K-6 math and science instruction.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Drive, Suite D-23, Tallahassee, FL 32301-2950 904-922-8533; 800-854-0476; FAX: 904-922-8068.

Interactive Mathematics Program (Grades 9-12)

Four-Year Core Curriculum Integrates Math Concepts from Many Topic Areas into a Problem-Based Math Program for All High School Students

Each unit of the Interactive Mathematics Program (IMP) is organized around a central problem or theme. Concepts and skills are learned in the context of the unit's central focus through a variety of routine and non-routine smaller problems. IMP's major goals are to expand and broaden who learns math, what mathematics is, and how it is taught.

Contact: Linda Witnov, Outreach Coordinator (outside CA), Interactive Mathematics Program, 6400 Hollis St., #5, Emeryville, CA 94608, 510-658-6400; FAX: 510-658-8920.

Jimmy Huntington School Caribou/Fisheries Project (Grades K-12)

Culturally Significant K-12 Integrated Science Project

The Jimmy Huntington School Caribou/Fisheries Project provides a hands-on, culturally relevant science experience for students in grades K- 12. The project is based on the philosophy that science should be taught every day through integration, should draw on the local environment, and should be culturally different. The project has three goals: to increase the amount of time students are exposed to science; to integrate science with the rest of the curriculum; and to utilize local resources and persons.

Contact: Michele B. Bifelt, Teacher, PO Box 69, Huslia, AK 99746 (Mail inquiries only).

The Kentucky K-4 Mathematics Specialist Program (Grades K-4)

A Staff Development Program for K-4 Math Teachers

The program developed a network of K-4 mathematics specialists across Kentucky through a pyramid approach to professional development. The program has three major goals: to establish a comprehensive, statewide network of K-4 mathematics specialists; to align Kentucky's K-4 mathematics content and teaching practices with the NCTM standards and Kentucky's Education Reform Act of 1990; and to provide opportunities for communication and collaboration.

Contact: Dr. William S. Bush, Director, College of Education, 305 Dickey Hall, University of Kentucky, Lexington, KY 40506-0017, 606-257-2927; FAX: 606-258-1046.

Marietta Hands-On Math (Grades K-5)

Hands-On Elementary Math Program

This is a K-5 math program which uses manipulatives to create hands-on concrete experiences in order to teach estimation, analysis, and problem solving to all types of students in regular classrooms. The basic goal is to demonstrate that systematic use of concrete manipulative materials during mathematics instruction improves concept development, problem solving, and computation as measured by achievement tests. Two additional objectives are to show that adequately trained teachers armed with proper materials will make a positive difference in mathematics instruction and that students in the classes of those teachers will engage in significantly more hands-on learning activities than will students in a traditional classroom.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476; FAX: 904-922-8068.

Math 2002 (Grades K-5)

Teachers and Student Teachers Work Together to Revise Traditional Math Instruction

Math 2002 is a professional development program which pairs regular classroom teachers with inservice student teachers to update traditional mathematics instruction. It also encourages the use of higher-order thinking skills, appropriate manipulatives, cooperative learning, and the use of technology in mathematics instruction. The developers feel that using appropriate curriculum resources and lesson plans encourages attitude changes that favor a life-long interest in mathematics.

Contact: Dr. Velma Yoder, Project Director, 302 Old Main, Messiah College, Grantham, PA 17027, 717-766,2511, Ext. 7053.

Mathematics Education Initiative/MOVE IT Math (Grades K-6)

K-6 Hands-on, Discovery Mathematics for ALL Children

MOVE IT Math is a K-6 university-supported professional development program. It advocates mathematics instruction based on the use of manipulatives. It consists of three 30-hour inservices: Everyone Can Learn Math, Enrichment & Accelerate, and Advanced Topics. MOVE IT Math seeks a balance between skills, concepts, and problem solving in order to: (1) elevate scores on standardized exams; (2) meet the challenge of changing demographics; (3) improve student attitudes toward mathematics and teacher attitudes toward teaching mathematics; (4) mainstream "at risk" students for mathematics; (5) aid "at-risk" students in meeting grade-level expectations; and (6) prepare students to participate in a mathematically literate global economy. An objective of the program is that all children will be ready for a quality algebra class in the 8th grade.

Contact: Dr. Paul Shoecraft, Director MEI, Lynne Shoecraft, Assistant Director, MEI, University of Houston-Victoria, 2506 E. Red River, Victoria, TX 77901, 512-576-3151; FAX: 512-572-8463.

Mathematics, Engineering, Science Achievement (MESA) (Grades 6-12)

Pre-college Support for Minority Students Interested in Pursuing Careers in Science, Engineering, and Math Related Areas

The MESA program encourages promising young minority students to focus on their futures as early as sixth grade and to consider future careers in engineering and science. It stimulates career awareness and motivation through field trips, role model speakers, competitions, incentive awards, college and career counseling, summer enrichment opportunities, and internships. MESA develops interest in science, engineering, and related fields. Its goal is to graduate students who are ready to enter universities fully prepared to succeed in an engineering or science major.

Contact: John Rael, Jr., Executive Director, Colorado Minority Engineering Association (CMEA), University of Colorado, College of Engineering, Campus Box 104, P.O. Box 173364, Denver, CO 80217-3364, 303-556-2344.

McQuesten Brook Wetland Study (Grades 9-12)

Hands-On Environmental Education Program Fosters Student Awareness and Learning

The Freshwater Wetlands Study Unit is a hands-on environmental education program for high school students. The curriculum includes an outdoor student location, student grouping which focuses on different aspects of study, (e.g., botany and zoology), and involvement of professionals in the field (e.g., representatives from New Hampshire Fish and Game, UNH Cooperative Extension Office) to produce a multi-authored final report, and a student-produced video. The main goals are to increase student awareness, interest, and involvement in a contemporary environment issue and to develop a custom-made curriculum on wetlands.

Contact: Ronald N. Miller, Biology Teacher, West High School, 9 Notre Dame Avenue, Manchester, NH 03102 (Mail inquiries only).

Michigan Mathematics Inservice Project (M²IP) (Grades K-8)

Teachers' Inservice Program Upgrades K-6 Mathematics Instruction

The Michigan Mathematics Inservice Project (M²IP) provides teachers with an opportunity to update mathematics teaching with elementary and middle school children. The primary goal of the project is to improve the mathematics achievement of grades K-6 students through inservice programs for teachers.

Contact: Barbara Sandall, North Central Regional Educational Laboratory, 1900 Spring Road, Suite 300, Oak Brook, IL 60521, 708-571-4700.

Microchemistry (Grades 9-12)

High School Microscale Chemistry Techniques

This program consists of over 40 lab activities using small-scale chemistry techniques in secondary school labs. The program extends the small-scale chemistry techniques begun by Dr. Hubert Alyea of Princeton University. He designed desk-top equipment for use in college chemistry courses conducted in an auditorium. This high school microchemistry lab utilizes still smaller and less expensive equipment, some of which is teacher-made. Goals are to increase student safety by using smaller amounts of chemicals; to decrease the amount of waste by working in drops or milligram quantities; to facilitate good science methods with techniques that permit replication and repetition within a single class period; and to increase laboratory time by integrating desk-top labs into the classroom lessons.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Drive, Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476; FAX: 904-922-8068.

Middle Grades Mathematics Project (Grades 6-8)

Early Introduction of Complex Mathematical Concepts

Middle Grades Mathematics Project (MGMP) introduces important mathematics in five 6-8 grade curriculum units which reflect the NCTM standards. It uses an instructional model to promote an atmosphere of problem solving and inquiry in the classroom. The primary goal of MGMP is to introduce middle school students to important mathematical concepts which are not normally introduced at this level. Through participation in inservice programs, teachers develop new teaching strategies which facilitate the students' new learning.

Contact: Barbara Sandall, North Central Regional Educational Laboratory, 1900 Spring Rd., Suite 300, Oak Brook, IL 60521, 708-571-4700.

Mister Goodmath (Grades K-5)

Interactive K-8 Math Curriculum Using Closed Circuit Television / Video Tapes and Peer Teaching

The Mister Goodmath program exposes teachers to a wide variety of computational systems and

problem-solving strategies not readily found in the district's basal textbooks. The program requires a teacher to assume the role of "Mister Goodmath," a colorful character, who introduces students to a new strategy or idea and challenges a different grade group to a problem of the week. This is done via closed circuit TV, live and taped. Students respond to the problem by writing to Mister Goodmath with the correct solution. The goal of the program is to offer students as many ways to attack each topic as possible. At the same time, teachers are exposed to math concepts which their methods courses did not cover or they have forgotten.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476; FAX: 904-922-8068.

New Hampshire Young Inventors' Program (NHYIP) (Grades 1-8)

Students Use Intervention and Problem Solving to Develop Critical Thinking Skills

New Hampshire Young Inventors' Program (NHYIP) helps students develop critical thinking and problem-solving skills by challenging them to invent solutions to everyday problems. A major component of this project is local and statewide Invention Conventions where students display their projects, meet other students and adult inventors, and receive recognition for their accomplishments. (There are even workshops for parents.) The NHYIP aims to develop student problem-solving capabilities and creativity by defining a real problem, formulating an original solution, developing a product, and sharing the results or products with appropriate audiences.

Contact: Susan W. Zehnder, Director, Academy of Applied Science, 98 Washington Street, Concord, NH 03301, 603-228-4530; FAX: 603-228-4730, 603-228-4730.

Newton K-6 Science Program (Grades K-6)

Hands-On Science Inquiry into Science Teaches Developmentally Appropriate Concepts and Skills

The Newton Science Program provides students with experience in differentiating relevant and nonrelevant data, asking and investigating answerable questions, and making the connections needed to learn concepts. Students learn to use various measuring devices such as a thermometer, meter/yard sticks, and balance and spring scales. Additional work includes constructing and interpreting charts and graphs and the use of a hand lens, microscope, and other scientific equipment. Students develop attitudes essential to the scientific process including curiosity, creativity, openness to new ideas, and appropriate skepticism. They become able to construct models and to test ideas in order to understand the world around them.

Contact: Maxine Rosenberg, Science Coordinator K-8, Science Center, 100 Walnut Street, Newtonville, MA 02160 (Mail inquiries only).

North Carolina Project for Reform in Science Education (Grades 6-8)

A Multidisciplinary Middle School Science Program

The North Carolina Project for Reform in Science Education (NCPRSE) is part of a nationwide initiative to provide meaningful science experiences to grade 6-8 students in biology, chemistry, earth, and physical sciences. Students initially encounter science concepts, principles, and laws at a concrete level through direct experiences with phenomenon. Later, students interact with science at successively higher levels of abstraction. The program is based on the axiom that "all children can learn." The teachers must redefine their role as imparters of knowledge and assume roles as facilitators, questioning and guiding each child.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533, 800-854-0476; FAX: 904-922-8068.

Northwestern State University Middle School Mathematics Project (Grades 4-8)

University Inservice Programs Translating the Mathematics Standards through Classroom Implementation

The Northwestern University Middle School Mathematics Project, developed as a component of LaSIP (Louisiana Statewide Systemic Initiative), is a six-week summer program consisting of three courses: Number Sense, Conceptual Algebra, and Quantitative Literacy. The methodology and teaching strategies advocated by the National Council of Teachers of Mathematics were included in the courses. After the intensive summer training, participants meet three times a semester in Saturday workshops to share experiences and gain new insights from their peers.

Contact: Stan R. Chadick, Project Director, Department of Mathematics, Northwestern State University, Natchitoches, LA 71497, 318-357-5033 or 318-357-5131; FAX: 318-357-5599.

Operation Physics (Grades 9-12)

Hands-On Teaching/Learning Strategies for Ethnically Diverse High School Physics Students

Operations Physics is designed to meet the needs of non-verbal students, especially those of ethnically diverse populations. It was created for students who have English as a second language and who learn science better through hands-on teaching/learning strategies. The goal of Operation Physics is to nurture critical thinking and a general interest and confidence in science for everyone.

Contact: Dr. Willa Ramsay, Physics Teacher, 6677 Bonnie View Drive, San Diego, CA 92119 (Mail inquiries only).

Overview Case Study Physics (OCS) (Grades 9-12)

Physics: From Conceptual Foundation to Case Study Problem Solving

Overview Case Study (OCS) Physics integrates data into a flexible, spiral format that helps students build a knowledge hierarchy on a foundation of qualitative understanding. The course is divided into conceptual blocks. Each block starts which an overview in which students construct conceptual models while observing simple experiments. Two types of supplementary materials have been developed to support OCS Physics instruction: (1) an OCS Study Guide supplements a conventional text, and (2) an ALPS Kit consists of a set of Active Learning Problem Sheets that are used to transform lectures into active learning experiences. They learn to reason qualitatively about physical processes using sketches and diagrams and analyze similar processes quantitatively using multiple-representation, problem-solving techniques.

Contact: Dr. Thor Stromberg, Professor of Physics, Department of Physics, Department 3D, Box 30001, New Mexico State University, Las Cruces, NM 88003, 505-646-1811.

A Problem Solving Approach to Mathematics Instruction (Grades 6-8)

Middle School Math Program Emphasizing Problem Solving

In A Problem Solving Approach to Math Instruction students analyze underlying mathematics principles and gain confidence in their math abilities by exploring concepts through manipulatives, games, group activities, application projects, and/or tactual activities. They write about ideas related to mathematics in daily, weekly, and quarterly assignments. Tests include open-ended questions and students analyze test errors and prepare written explanations of those errors. Goals are to have students understand underlying mathematics concepts; to have them select and use available tools and technology appropriately; to communicate verbally and write the thought processes used to solve mathematical problems; to develop confidence in their own ability to solve problems; and to transfer mathematics applications to other topics within the course curriculum, other mathematics courses, and other subjects.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476; FAX: 904-922-8068.

Process Skills Assessment Kits (Grades K-5)

Developmentally Appropriate, Hands-On Science Assessment Kits

Science Process Skills Assessment Kits provide teachers with developmentally appropriate tasks to assess students' strengths and weaknesses and then plan appropriate hands-on instruction. The goal is to continue to improve science teaching by developing an assessment program that is teacher friendly and provides a favorable vehicle for learning.

Contact: Kit Peixotto, Northwest Regional Educational Laboratory, 101 SW Main Street, Suite 500, Portland, OR 97204-3212, 503-275-9500.

Program Assessment: An Approach for Improving Instruction in Science (Grades K-9)

Performance-Based Activities Measure Curriculum and Instructional Effectiveness Against New Standards

The ANESU Math and Science Assessment Program measures the effectiveness of curriculum and instruction in meeting NCTM and NCISE standards. The program features performance-based assessment activities and a program assessment component based on student performance and teaching practices. It also includes a cyclical timeline providing ongoing, continual program evaluation in math and science and many locally developed assessment instruments such as surveys and instructional portfolios. Assessment activities are carried out by staff and faculty members with input received from students, faculty, parents, and community members. The primary goal is to increase the quantity and improve the quality of student learning and growth in the district schools. Additional objectives are to assess educational inputs, implementation, and outputs; to be positive, engaging, and compatible with teaching and learning activities; and to provide useful information to teachers in an ongoing formative and summative manner.

Contact: Pedie O'Brien or Neal Donahue, Assessment Committee Member, Bristol Elementary School, 57 Mountain Street, Bristol, VT 05443.

Project LABS (Learning About Basic Science) (Grades K-12)

Teacher / Scientist Teams Design Activities for Classroom Use

Project LABS is an academic-instructional partnership developed by the Rohm and Haas Company. It addresses the growing need for a technically literate work force by creating technology-based activities for school use. Each summer, teams of Rohm and Haas scientists and science teachers from the region spend work time at a Rohm and Haas facility developing innovative science activities. This project has two basic goals: (1) to improve hands-on science application activities in schools, and (2) to foster direct involvement of scientists in science education.

Contact: Dr. Helen Burke, Program Coordinator, Chestnut Hill College, 9601 Germantown Avenue, Philadelphia, PA 19118, 215-248-7194.

Project LIFE (Grades 6-8)

Revitalizing Science Education by Modeling the NSF Statewide Systemic Initiative

Project LIFE revitalizes science education in 26 parishes of North Louisiana and models reforms mandated by the National Science Foundation's (NSFs) Statewide Systemic Initiate. Teacher participants develop knowledge, skills, and confidence to use an investigative approach to teaching science. Follow-ups include five workshops during the school year, newsletters to teachers and students, and site visits. The project aims (1) to improve the science content knowledge of teachers, and ultimately their students, in the areas of behavior/organism biology, ecology/ population biology, and environmental science; (2) to teach science by modeling the behaviors that are used in the process that is science; and (3) to capture the spirit of reforms in science espoused by the National Science Foundation and LaSIP (Louisiana Systemic Initiative Program).

Contacts: Linda Ramsey/David Radford, Project Co-Directors, Project LIFE: Dept of Biological Sciences Technical University, PO Box 3179-TS, Ruston, LA 71272, (318) 257-4573; FAX: 318-257-4288.

Project Peak (Grades K-8)

Magnet Schools for Math and Science

The Chickasaw and Clark Schools of Mathematics and Science established one elementary magnet and one middle magnet school during the 1991-1992 school year. The purposes of the program are to eliminate, reduce, or prevent the isolation of minority students and to provide students with courses of instruction that will reflect new math and science standards. The goals of the program are to document the improvement of the student's self esteem, competency level in labs, and classroom and computer academic performance; to increase the student's interest in math and science related fields; and to provide an integrated atmosphere of acceptance and mutual respect for one another.

Contact: Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533, 800-854-0476; FAX: 904-922-8068.

Project SMART (Science and Mathematics for Arizona's Rural Teachers) (Grades K-8)

Rural Teacher Consortia for Leadership and Staff Development as well as Technical Assistance

Project SMART is a model for rural regional training and resource centers to support change and improvements in small schools. It has been instrumental in leveraging state Eisenhower funds to be allocated to seven other rural regional training centers for several consortia of rural districts. The primary goal is to help teachers and administrators to develop the understandings, positive attitudes, and abilities to teach good mathematics and science. Project SMART also seeks to gather and disseminate information on rural staff developments, instructional support, curriculum implementation, and partnerships, and to establish a working network of administrators and teachers from rural areas focused on science and math improvement.

Contact: Brownie Sternberg, Project Director, 700 McNab Parkway, San Manuel, AZ 85631.

Sandpiper in Space (Grades K-6)

K-6 Multi-Disciplinary Science and Math Program Focused on Space Science

In Sandpiper in Space, students "experience" life in space by participating in space-related activities in a mock 26-foot space shuttle. The goals are: (1) to stimulate and motivate students' interest in science, and (2) to teach and reinforce higher-order thinking. In-school activities are supplemented by major field trips, such as Space Camp, and by encouraging students to join out-of-school activities such as after-school Young Astronauts and summer activities for individual students. Computer-assisted simulations of space flights challenge students to work together to make decisions and pursue scientific investigation.

Contact: Mrs. Marge Masino, Science Chairperson, Sandpiper Elementary School 6724 East Hewarn Road, Scottsdale, AZ 85254 (Mail inquiries only).

Saturday Science (Grades 8-9)

Program Teams Educators and Scientists to Develop a Science Curriculum

Saturday Science is a partnership between the school and the E.I. DuPont Corporation. Annually, the science teacher and the industry chemist author, teach, and evaluate a science curriculum which is based on the needs and experience of the volunteer students and the interests of the industry. The program is delivered in a collegial atmosphere with no grades or other formal evaluation of student progress. The program has five goals: (1) to increase science literacy within the school community; (2) to allow students to see themselves as future scientists; (3) to enrich students' science experience; (4) to provide a network of science educators and industry professionals who will aid students involved in science research; (5) and to improve the school's ninth-grade science achievement scores.

Contact: Martha W. Mullins, Teacher, DuPont Jr High School, 121 E. Central Avenue, Belle, WV 25015 (Mail inquiries only).

Science Alliance (Grades K-12)

Alliance Between Schools and Industry Enhances Current Curricula

Science Alliance is an education/industry collaboration that meets the increasing need for a scientifically literate population and for individuals interested in pursuing science/technology careers. The main goal is to tap into the classroom experience of the teacher and the subject expertise of the scientist in order to create teaching modules around existing curricula topics. These modules approach science theory from a different perspective - a personal, practical one which integrates science with other subjects and the world.

Contact: Mary Ribeiro, Executive Director, P O Box 833, 64 West End Avenue, Somerville, NJ 08776 908-725-6032.

Science Mentorships (Grades 7-8)

Mentoring Program in Science for Gifted Middle School Students

This is a middle school mentorship program. Seventh and eighth-grade students with a strong interest in science apply to work with a research scientist. Students become familiar with labs and develop a relationship with scientists. Students, with the assistance of a scientist, design a project that will be completed and then described to an audience at the end of the year. Goals are to provide gifted students with an overview of career possibilities and hands-on experiences under the direction of a science professional.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Drive, Suite D-23, Tallahassee, FL 323012950, 904-922-8533; 800-854-0476; FAX: 904-922-0868.

Science Teams (Grades 4-8)

Staff Development Program for Upper Elementary and Middle School Science Teachers

Science Teams is a staff development program which shows teachers how to use cooperative learning techniques and hands-on activities to make science fun. The goal is to improve science teaching skills of teachers in order to improve science achievement for all students. Specifically, the program tries to increase the time students spend conducting experiments, using cooperative learning, and learning about science careers and societal issues.

Contact: Dr. Aleta You Mastny, Project Director, Rutgers University, Consortium for Educational Equity, Building 4090, Livingston Campus, New Brunswick, NJ 08903 908-445-2071.

Search, Solve, Create and Share (SSCS) (Grades K-12)

An Interdisciplinary Approach to Problem Solving in Math and Science

Search, Solve, Create and Share is a problem-solving instructional model which provides students with concrete experiences for learning meaningful science. The student is encouraged to conduct a search of what is known and to extend that knowledge base through application or problem solving. The primary goal is to provide an environment which encourages students to learn problem solving and science concepts through concrete experiences. In addition, the students expand and apply existing knowledge and critical thinking skills while generating new knowledge using a constructivist approach.

Contact: Barbara Sandall, North Central Regional Educational Laboratory, 1900 Spring Road, Suite 300, Oak Brook, IL 60521, 708-571-4700.

Snapfinger Academy of Mathematics, Science, and Technology (Grades 4-7)

A Magnet School in Math, Science, and Technology for Students in Grades 4-7

Snapfinger is a math, science, technology magnet school for grades 4-7. The use of a guided discovery approach allows students unique opportunities to develop their mathematics and science skills as well as their critical thinking skills. Teachers learn to use an interdisciplinary approach which combines math and science. The Snapfinger program adheres to standards set forth by the National Council of Teachers of Mathematics. Its goal is to build on the students' prior knowledge and experiences and develop mathematics thinking skills that convince students of the validity of particular representations, solutions, and conjectures. A major focus of the program is the application of science content and concepts to students' personal and community lives.

Contact: SERVE Consortium for Mathematics and Science Education, 345 South Magnolia Drive, Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476, Fax: 904-922-8068.

Sold on Science (Grades K-5)

Elementary Science Laboratory Program Using Prepackaged Kits

Sold on Science is an elementary laboratory program that ensures readily available materials for teachers who direct hands-on discovery learning. The objectives of the program are to: (1) increase positive laboratory experiences through activity-oriented lessons; (2) increase emphasis on the process skills of science; (3) present science and technology as problem-solving tools; and (4) develop a positive attitude toward science and technology in all students, especially girls.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476 FAX: 904-922-8068.

TACO (Take A Class Outdoors) (Grades 9-12)

A High School Science Program for Female Students

Take A Class Outdoors stimulates thinking about scientific and engineering careers, develops logical reasoning and problem-solving skills, promotes positive attitudes toward science, and increases the student's interest and knowledge about scientific work. The main goal of the program is to encourage young women to take higher level science courses and consider science related careers.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Drive, Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476; FAX: 904-922-8068.

Teacher Enhancement Through Student Research Projects (Grades 9-12)

Developing Mathematical Problem Solving and Communication Skills through Student Research Projects

Teacher Enhancement Through Student Research Projects is a high school mathematics program based on "student research projets." While completing a project, students read, write, and discuss mathematics. The program was designed by college faculty and high school classroom teachers who participated in a university program modeling the ideal use of research projects as a teaching/learning strategy. The use of scientific investigation creates a means for developing higher-order thinking skills, and all activities are consistent with the standards of the National Council of Teachers of Mathematics.

Contact: Dr. Douglas Kurtz, Professor of Mathematics, Department of Mathematical Sciences, New Mexico State University, Las Cruces, NM 88003-0001, 505-646-1410 or 505-646-3901 (Dept.); FAX: 505-646-6218 (ext. 390).

Teacher Training for Technology in the Mathematics Classroom (Grades 7-12)

Instructional Technology for Algebra Classrooms

Teacher Training for Technology in the Mathematics Classroom assists school districts and teachers in implementing technologically appropriate mathematics instruction. The project is based on the following: (1) the mathematical reform movement led by the National Council of Teachers of Mathematics; (2) the belief that mathematics should be accessible to all students; and (3) the importance of computer accessibility for all mathematics students. The project breaks with traditional staff development and emphasizes the development of lessons and units by teachers.

Contact: Linda K. Griffith, Associate Professor, UCA Box 4912, 201 Donaghey Avenue, Conway, AR 72035-0001, 501-450-5663; FAX: 501-450-5208.

TEAMS Distance Learning (Grades 4-6)

Live, Interactive Mathematics and Science Distance Learning Program Providing On-Going Staff Development

TEAMS is based on the philosophy that all students, particularly those in at-risk inner city schools, can be challenged to be successful learners of math and science through a hands-on, constructivist approach to learning. TEAMS seeks to improve the level of science and math instruction by providing an inclass longitudinal retraining program for elementary teachers across the United States. Through TEAMS, students learn to value mathematics and science. They become confident in their own ability to become scientific thinkers and mathematical problem solvers.

Contact: Donald S. Lake Senior Project Director, 9300 Imperial Highway, Room 250, Downey, CA 90242-2890, 310-922-6635.

TECH (Technology Education Center at Hemingway) (Grades K-6)

Hands-On Elementary Science and Technology Program

The TECH program provides a hands-on, minds-on, multidisciplinary environment where students of all ages and abilities apply critical thinking skills, knowledge, and the tools of technology to solve practical real world problems. The purposes of the program are to teach students to become technologically literate citizens using the real tools of technology whenever possible; to provide them with an awareness and understanding of how people direct their environment through problem-solving decisions; and to assess the effects of technology on society and the environment.

Contact: Terry Thode, TECH Room Teacher, Box 1450, Hailey, ID 83333, 208-726-3348.

Technology for Teens/SmartLab (Grades 6-8)

An Integrated Middle School Program to Teach Scientific Concepts Using Computers and Robotic Toys

Technology for Teens/SmartLab is an integrated program stressing science, mathematics, computers, and reading. The thematic units are planned collaboratively by the teachers. Its primary thrust is learning scientific concepts through the cooperative investigation of real problems using technology made available to the students through robotic toys and computers. Achievement is determined by authentic assessment measures collected in student portfolios and demonstrated in exhibitions. The major goal of the program is to encourage students to develop problem solving. scientific, and critical thinking skills needed for the 21st century. In addition, the interrelatedness of science and the rest of the world of knowledge is a major program thrust.

Contact: Daisey Holley, Science Teacher, Sissonville Middle School, 8316 Old Mill Road, Sissonville, WV 25320, 304-348-1993.

Tools for Scientific Thinking-Force Motion/Force Unit: A Microcomputer Based Laboratory (Grades 9-12)

High School Program Using Microcomputers to Help Students Attain Newtonian View of Motion and Force

The Microcomputer-Based Laboratory Motion/Force Unit is a program that encourages and assists students to use electronic tools to generate data from the physical world and to use the data to construct their own meaning about scientific concepts. An important feature of the Motion/Force Unit is its award-winning software which makes it possible for students to carry on detailed and sophisticated analysis of data. The goals of the program are to have students attain a Newtonian view of motion and force, including a thorough comprehension of the concepts basic to distance, velocity, acceleration, and force; to improve student graphing and other science skills, particularly data analysis; and to have students practice working effectively and productively in small groups.

Contact: Professor Ronald K. Thornton, Director, Center for Science and Mathematics Teaching, Tufts University, Medford, MA 02155 (Mail or FAX inquiries only) FAX: 617-627-3901.

Top Chem (Grades 9-12)

Authentic Chemistry Supplemental Lab and Teacher Prep Activities

Summer training institutes (begun in 1982) provide two week intensive experiences modeling developmentally appropriate laboratory teaching strategies for selected 9-12 grade chemistry teachers from throughout Oklahoma. Strategies emphasized in the program include the use of the laboratory as a discovery activity to introduce a topic, cooperative learning, and the use of pooled data. Authentic science laboratory activities that use safe, inexpensive chemicals have been collected and a book of supplemental material has been developed. The Top Chem program uses safe inexpensive activities to teach chemistry to students who are in the formal operational stage of development. Its goals are to: (1) help teachers feel comfortable with hands-on activities; (2) provide simple, safe and inexpensive activities; (3) provide supplementary activities; (4) instill in teachers a healthy skepticism and positive attitude towards science that students can emulate; and (5) encourage teachers to use the lab as a discovery tool rather than a verification tool.

Contact: Donald G. Stafford, Professor of Chemistry, 2202 Fullview, Ada, OK 74820, 405-332-8000 ext. 492, FAX: 405-521-6516.

Using the Outdoors to Teach Experiential Science (Grades K-6)

Science Program Using School Grounds as a Living Lab

This program enhances the academic performance of all students by developing a site-based model that integrates science curriculum programs with outdoor laboratories. The program selects 10 elementary schools per year and provides a large number of teachers at each of the schools with one year of intensive training on how to utilize their school grounds to teach hands-on science. The goals of the program are to provide teachers and students with basic information, to facilitate experiences with living things, and to develop a school-based plan for using the school grounds as an outdoor living laboratory.

Contact: SERVE Consortium for Mathematics and Science Education, 345 S. Magnolia Dr., Suite D-23, Tallahassee, FL 32301-2950, 904-922-8533; 800-854-0476; FAX: 904-922-8068.

Workshop Physics (Grades 9-12)

Problem-solving physics program using computers

Workshop Physics is a developmentally driven curriculum that uses computer-based lab work to lead students to discover the underlying principles of physics. Students work in small groups and use computers as tools to gather and analyze data. The overall goal is for students to gain a real understanding of physical theories.

Contact: Maxine C. Willis, Gettysburg Area Senior High School, Lefever Street, Gettysburg, PA 17325 (Mail inquiries only).

1994 PRACTICES BY TOPIC

Middle-Secondary School Science (includes preservice)

Technology-Centered Practices

PROGRAMS THAT WORK

FROM THE NATIONAL DIFFUSION NETWORK (NDN)

THE NATIONAL DIFFUSION NETWORK

The National Diffusion Network (NDN), administered by the U.S. Department of Education, is a dissemination system that helps public and private schools, colleges, and other educational institutions improve by sharing exemplary programs, practices, products, and processes. Since its inception 21 years ago, NDN has grown from a small collection of federally funded programs to a national database of some 400 programs, spanning the core content areas and a host of cross-cutting topics, including cognitive skills and schoolwide reform.

To support and encourage this dissemination system, the Department of Education awards dissemination grants to three types of projects.

> DEVELOPER DEMONSTRATOR PROJECTS to make others aware of effective education programs, products, and practices and to provide training, curriculum materials, and follow-up assistance to those interested in using the exemplary project.
>
> STATE FACILITATORS to serve as linkers within each state between NDN projects and teachers, administrators, parents, and others who are interested in implementing the projects. In addition, State Facilitators provide information on schools recognized by the School Recognition and Drug-Free School Programs, ERIC, and the OERI-supported Laboratories and Centers.
>
> PRIVATE SCHOOL FACILITATOR to serve as a linker between NDN projects and private schools throughout the nation.

Projects disseminated by the National Diffusion Network are often developed locally, and tried and field-tested with students and teachers. Every project has demonstrated its effectiveness to the Department of Education's Program Effectiveness Panel. This means not only that the projects were effective at their development site, but also that they can be used successfully at other sites.

Projects funded by the NDN assist local schools by providing training and consultant help to those implementing the project at a new site. Follow-up assistance, additional training, on-site visits, and evaluation help are also available. NDN projects are developed by teachers and administrators who provide implementation assistance to other teachers and administrators. NDN programs are a cost-effective way of improving instruction when compared to the cost of developing a new program.

In 1994 the National Diffusion Network funded 89 projects out of about 200 that are available for dissemination. Projects span the content areas that are of interest and concern to local public and private schools and reflect most age and ability levels.

Developer Demonstrator Projects disseminate a wide array of programs, products, and practices. For example, in the area of elementary science, current projects reflect the increasing emphasis on hands-on activities and inquiry oriented instruction. Four physics projects at the secondary level are in demand in response to the growing number of high schools that are increasing graduation requirements in science. These projects meet the need for instructional materials that help teach the more difficult physical science concepts and motivate students to learn concepts through relating physics to the lives of high school students. With respect to mathematics, many NDN projects incorporate problem solving, estimation, and other recommendations of the National Council of Teachers of Mathematics standards for school mathematics.

The NDN also offers proven practices in other areas. Among them are: improvement of teaching and the quality of instruction, special education, programs for gifted and talented students, adult and family literacy, career and vocational education, writing, health, school-wide and district-wide improvement programs, history and civics, problem solving and philosophy, literature, the humanities, physical education, and programs for at-risk students.

Each Developer Demonstrator project receiving federal dissemination funds maintains a demonstration classroom or school where visitors are welcome. These projects are located across the United States. In addition, many of the projects have demonstration sites in states other than the one in which they were developed. NDN State Facilitators arrange for visits to a demonstration school or to an adoption site.

The NDN State Facilitators and the Private School Facilitator help schools and other organizations learn about and adopt NDN programs. Often, for example, they hold "awareness conferences" featuring one or more NDN programs and invite educators to attend. They also work with educators in identifying the needs in a particular school and in determining which NDN program offers a solution. When a school decides to adopt an NDN program, the facilitator arranges for the program's developer to provide training to staff in the adopting school. In addition, if a school requires financial assistance to make an adoption, the facilitator usually knows funding sources and how to apply for a grant under various federal, state or local programs or from private foundations or industry. Some facilitators sponsor meetings for administrators on how to apply for financial assistance.

Always NDN's aim has been to provide adoption assistance at minimal cost. State Facilitators are supported by NDN grants; so there is no cost for their services. An adopter usually pays for any required curriculum materials and for release time for teachers to attend training. Some schools help meet adoption costs with a grant from local or state funding sources or with funds from other sources including the private sector.

Each Developer Demonstrator project has basic requirements to be met by adopters. Adopting schools for example, are usually required to implement certain basic features of the program, such as regular monitoring of students' academic progress or the use of certain activities. Some programs may require the adopting schools to compile data to measure the effectiveness of the program implementation. Each adopter agrees to an adoption plan that outlines roles and responsibilities of the parties concerned.

During school year 1992-93, NDN programs were installed in approximately 35,600 schools. An estimated 141,500 teachers and other school personnel received training in the use of NDN programs, and these adoptions served over six million students. Several evaluations of the NDN show that it is meeting its goal of helping schools improve education through the dissemination of effective programs.

An education program is validated as effective by the Program Effectiveness Panel (PEP) before being offered to schools through the National Diffusion Network. A program is first developed and field tested with its intended audience.

Program developers must collect evaluation data that support their claims of effectiveness. In addition, the program should be transportable to other sites. Projects that receive PEP approval become part of the NDN and are eligible for federal dissemination funds. Once funded for dissemination as a new Developer Demonstrator Project, the project staff are able to offer to interested schools consultant services and limited assistance with the training and materials associated with installing a project in classrooms around the country.

The Improving America's Schools Act of 1994, which amends the Elementary and Secondary Education Act (ESEA), reauthorizes NDN for the next five years. This new legislation connects NDN to a new system of comprehensive regional assistance centers dedicated to providing training and technical assistance related to programs administered under the Act. The law charges State Facilitators with (1) making technical assistance referrals to the comprehensive centers and other sources and (2) identifying and implementing exemplary programs or promising practices. The legislation enlarges the role of the State Facilitators to include such functions as defining technical assistance needs (including technology), securing services to meet those needs, using technology as a dissemination tool, and disseminating information about school

reform and effective and promising practices. It no longer ties the Facilitator to disseminating only validated programs.

The legislation also authorizes the development of a system for validating effective programs and promising practices and a grant program to disseminate and provide technical assistance related to this system. The law names three priorities: effective schoolwide projects, programs addressing the needs of high-poverty schools, and programs with the capacity to offer high-quality, sustained technical assistance. The primary mission of the new NDN system will be to contribute to educational improvement by helping educators and others select and use important research-based ideas, practices, and processes.

The NDN will continue to be a state-based network. It will offer the national resources of validated programs and promising practices to educators interested in reform. It will continue to view dissemination as a two-way process centering around personal contact between disseminators and classroom teachers or school administrators.

NDN will be an integral part of a Department system for research, development, dissemination, and technical assistance. Formal relationships will be established among entities such as the ESEA comprehensive regional centers, OERI regional laboratories and institutes, and the NDN. For more information, contact Stephen Balkcom at 202-219-2089.

PROGRAMS THAT WORK IN MATHEMATICS AND SCIENCE EDUCATION

New Validated NDN Projects

ATTAINMENT OF ALGEBRA I SKILLS: CORD APPLIED MATHEMATICS 1 AND 2. (Grade 8)

The program is oriented toward the application and practice of mathematics concepts and skills in hands-on laboratories and uses practical, world-of-work problems. Each of 36 units in the program learning materials is an integrated package made up of supporting parts: Video Program, Student Text, Teacher's Guide, and text sections such as Laboratory Activities, Student Exercises, Student Handouts, Problem Bank for End of Unit Test, and Glossary.

Contact: Constance H. Todd, Center for Occupational Research and Development, (CORD), P.O. Box 21689, 601 Lake Air Drive, Waco, TX 76708-1689, 817-772-8756 or 800-972-2766; FAX: 818-772-8972.

CAPACITOR-AIDED SYSTEM FOR TEACHING AND LEARNING ELECTRICITY (CASTLE)
(Grades: beginning physics at any high school grade level)

The program curriculum emphasizes small group, hands-on investigations and discussion of electric circuits that students construct themselves. The use of capacitors and transient bulb lighting makes CASTLE unique among other instructional materials in electricity. Circuits are constructed with components contained in student equipment kits; the investigations are guided by a student manual, which is duplicated and distributed in the classroom.

Contact: Melvin S. Steinberg, Physics Department, Smith College, Northampton, MA 01063, 413-585-3884, FAX: 413-585-3786; Camille L. Wainwright, Director of Teacher Education, Pacific University, Forest Grove, OR 97116, 503-359-2205, FAX: 503-359-2907.

MANEUVERS WITH MATHEMATICS (MWM) (Grades 5-8)

MWM offers hands-on, problem-solving activities and makes full use of the scientific calculator as a tool to enable students to investigate. Students solve problems, make conjectures, reason, investigate mathematical relationships, look for connections among mathematical quantities, and use manipulatives.

Contact: David Page, Project Director & Kathryn B. Chval, Associate Project Director, The University of Illinois at Chicago (m/c 249) 851 South Morgan Street, SEO 1309, Chicago, IL 60607-7045, 312-996-8708.

PROGRAM FOR ACCESS TO SCIENCE STUDY (PASS) (Grades: unprepared college students interested in pursuing science-based careers)

PASS consists of a preparatory science course and a special counseling seminar taught in tandem. Academic preparation includes problem solving using chemistry and physics content. A general problem set related to a specific topic and an illustrative lab experiment is introduced. Students then perform the experiment, analyze the data obtained, work on a problem set based on the experiment, and take a quiz.

Contact: Michael Weiner, Chemistry Department, City College of New York, New York, New York 10031, 212-650-8337, FAX: 212-650-6107.

PROJECT SEED (Grades 4-6)

Project SEED is a program that brings specially trained mathematicians and scientists into low income elementary school classrooms to teach topics from algebra and higher level mathematics using a Socratic, group-discovery method of instruction. This question-and-answering approach encourages vigorous student discussion and high levels of participation from students at all ability levels.

Contact: Helen Smiler, National Projects, Coordinator, Project SEED, Inc., 2530 San Pablo Avenue, Suite K, Berkeley, CA 94702, 510-644-3422, FAX: 510-644-0566.

SYSTEMIC TECHNOLOGY PLANNING TO SUPPORT EDUCATIONAL REFORM (STPSER)
(Grades: Staff of schools, school-districts and SEAs)

STPSER is a planning process that uses a collection of electronic information gathering templates/tools to assist education community in developing technology-based education initiatives that can be integrated into school curriculum. Using a consensus-building process, district staff are assisted in producing a five-year educational technology plan within a six-month period.

Contact: John R. Phillip, Executive Director, Center for Educational Leadership and Technology, 165 Forest Street, Marlborough, MA 01752, 508-624-4877, FAX: 508-624-6565.

ACADEMICALLY TALENTED YOUTH PROGRAMS (ATYP), MATHEMATICS (Grades 7-8)

A program of accelerated instruction in mathematics for junior high school students with exceptional mathematical ability. Instruction, often by college and university professors, occurs in a two-and-a-half-hour class weekly during the school year and emphasizes the conceptual and theoretical framework of mathematics.

Contact: Carol R. McCarthy, Director, Academically Talented Youth Programs, Mathematics, Kalamazoo College, 1200 Academy Street, Kalamazoo, MI 49007, 616-383-8550 or 616-383-8468.

ACADEMY OF FINANCE (Grades 11-12)

An extensive academic and work experience program designed to prepare high school students for entry-level careers in financial services. This program stresses communication skills, analytic thinking, and workplace basics.

Contact: Susan Zimmy, National Academy Foundation, 235 Park Avenue South New York, NY 10003, 212-420-8400 or 212-754-0040.

CALCULATOR ASSISTED MATHEMATICS FOR EVERYDAY LIVING (CAMEL) (Grades 9-10)

An individualized 2-year program for those general mathematics students who have little or no success in mathematics. These students usually have computational deficiencies that preclude their mastering many of the "living skills" concepts that are part of everyday life for most people.

Contact: Shirley M. Mendez, Ph.D., Project CAMEL, 1105 East Fifth Street, Metropolis, IL 62960, 618-524-2664; FAX: 618-524-2665.

CAREERWAYS 2000 (Grades 8-12)

A program to focus students' attention on more skills, attitudes, and abilities to afford them the widest variety of educational opportunities and career options in the future. Featuring six motivational 30-minute videotapes, each focusing on an identified cluster of careers. Accompanying the videotapes is the *Careerways 2000 Teacher's Guide*, divided into units which contain student activities.

Contact: Jerry McLeroy, Disseminator, Los Angeles Unified School District, 1320 West Third Street, Room 406, Los Angeles, CA 90017, 213-625-6695 or 213-625-6681.

CHAPTER 1: HIGHER ORDER THINKING SKILLS PROJECT (H.O.T.S.) (Grades 4-6)

A program which replaces traditional drill and practice activities and content instruction in compensatory programs with thinking activities designed to generate the gains in basic skills expected from Chapter 1 programs. It is conducted in a lab equipped with Apple computers (Apple IIe, Apple IIgs, or Macintosh LC), with a detailed curriculum and a teacher trained in Socratic dialog techniques.

Contact: Christi Estrada or Dr. Stanley Pogrow, University of Arizona, College of Education, Tucson, AZ 85721, 602-621-1305, FAX: 602-621-9373.

COMPREHENSIVE SCHOOL MATHEMATICS PROGRAM (CSMP) (Grades K-6)

A complete elementary-level math curriculum from basics to problem solving for students of all ability levels. The content is presented not as an artificial structure external to children's experiences, but rather as an extension of those experiences, both at real-life and fantasy levels. Children are led through problem-solving experiences presented in game-like, story settings.

Contact: Care Heidema, Director, CSMP, 2550 South Parker Road, Suite 500, Aurora, CO 80014, 303-337-0990.

COMPUTER ASSISTED DIAGNOSTIC-PRESCRIPTIVE PROGRAM (CADPP) (Grades 3-9)

A computer-managed program that generates educational plans as the basis for a diagnostic-prescriptive approach to instruction. This relational database software program provides an alternative for teachers who manually prepare individual student prescriptions by automating the task of preparing Individual Educational Plans (IEPs). Developed for administrators, teachers, and parents of ECIA Chapter 1 students (formerly ESEA Title 1) to meet Chapter 1's federal requirement to develop and maintain an IEP for participating students.

Contact: Debra J. Roberson, Technology in Education Corporation, Inc., 3936 West 78th Court, #21, Merrillvill, IN 46410, 219-769-1712.

COMPUTERS HELPING INSTRUCTION AND LEARNING DEVELOPMENT (Project CHILD) (Grades K-5)

A computer-integrated instructional program for the elementary school, Project CHILD seeks to modify the school structure and create classroom conditions conducive for learning with technology, create cohesive units of work that foster strategies for thinking, and realign curriculum for reading, language arts, and mathematics.

Contact: Doug Applegate, Daniel Memorial Institute, Inc., 6700 Southpoint Parkway, Suite 100, Jacksonville, FL 32216, 904-448-7612 or 800-226-7612; Sarah M. (Sally) Butzin, Daniel Memorial Institute, Inc., P.O. Box 13296, Tallahassee, FL 32317, 904-385-6985 or 800-940-6985.

CONCEPTUALLY ORIENTED MATHEMATICS PROGRAM (COMP) (Grades 1-8)

COMP is an objective-based, mastery learning mathematics program that provides sequential mastery skills with corresponding instructional materials to be mastered in the basic skills area of mathematics. It is designed to meet individual needs through small-group instruction.

Contact: L. Leon Webb, Director, Pat Solem, Staff Development Specialist, Lois Peterson, Secretary, 161 East First Street, Suite 5, Mesa, AZ 85201, 602-969-4880.

CONSERVATION FOR CHILDREN (Grades 1-6)

A practical, economical program to increase conservation awareness, understanding, and action of elementary school children through a variety of basic skill activities designed for use in the classroom.

Contact: Marilyn Bodourian, Director of David Lidstron Conservation for Children, 1140 Boston Avenue, Longmont, CO 80501, 303-651-2829, FAX: 303-776-5934.

CONTENT READING INCLUDING STUDY SKILLS (CRISS) (Grades 4-12)

A program to provide students in grades 10-12 with the content learning strategies and study skills they need to retain course information. Based in reading theory, the program's components range from analyzing textbooks and teaching text organization to helping students identify the main idea of a selection.

Contact: Lynn Havens or Carol Santa, CRISS, School District #5, 233 First Avenue East, Kalispell, MT 59901, 406-756-5015, ext. 44.

COORDINATED LEARNING INTEGRATION—MIDDLESEX BASICS (CLIMB) (Grades K-12)

A skills-based program of reading, writing, and mathematics instruction for students of all ability levels, including Chapter 1, special education, and migrant education.

Contact: Barbara Brenner, Director, Project CLIMB, Middlesex Public Schools, Administration Offices, Kennedy Drive, Middlesex, NJ 08846, 908-968-4494 or 908-968-2666.

CUPERTINO CONCEPT: COMPUTER LITERACY AND BEYOND PROGRAM (Grades K-8)

This program, through an integrated use of technology in the curriculum, aims to develop fully functional students empowered to deal with an information-based society through development of skills for assessing, creating, and manipulating information products and services.

Contact: Barbara Caligiuri, Cupertino Union School District, 10301 Vista Drive, Cupertino, CA 95014, 408-252-3000 ext. 340 or 408-353-4584.

DECISION-MAKING MATH (DMM) (Grades 7-8)

DMM is a supplementary problem-solving program that teaches problem-solving and decision-making skills to develop students' mathematical power. Focuses on the Curriculum and Evaluation Standards of the National Council of Teachers of Mathematics (NCTM) and the National Goals.

Contact: Laura Dunn and Kristine A. Shaff, Co-Directors, Education and Technology Foundation, 4655 25th Street, San Francisco, CA 94114, 415-824-5911.

DEVELOPMENTAL APPROACHES IN SCIENCE AND HEALTH (DASH) (Grades K-3)

A comprehensive program designed to develop scientific literacy by facilitating the learning and application of basic concepts and skills in science, health, and technology in authentic, practical ways.

Contact: Donald B. Young, Curriculum Research & Development Group, University of Hawaii, 1776 University Avenue, Honolulu, HI 96822, 808-956-6918, FAX: 808-956-4114.

DIAGNOSTIC PRESCRIPTIVE ARITHMETIC (DPA) (Grades 3-5)

DPA is a process-oriented program emphasizing the development and refinement of teacher modeling and questioning skills. It includes counting, place value, addition, subtraction, multiplication, and division of whole numbers. Problem-solving skills are developed and reinforced through ongoing experiences with estimation and approximation, data collection, organization and interpretation, and real-life applications of arithmetic skills.

Contact: Bonnie Hawthorne, Kessler School District #2, 2420 Choteau, Helena, MT 59601, 406-442-0150 or Sally Logan, 417 North Main, Louisiana, MO 63353, 314-754-5953.

EFFECTIVE VIDEODISC INSTRUCTION IN CORE MATHEMATICS CONCEPTS (Grades 5-7)

This program enhances the ability of teachers to provide instruction in mathematics through the classroom use of videodiscs.The technology is used to emphasize prerequisite skills, providing systematic review and guided practices in small steps.

Contact: Alan Hofmeister, Technology Division, Developmental Center for Handicapped Persons, Utah State University, Logan, UT 84322-6800, 801-750-3718.

FIRST LEVEL MATHEMATICS (KINDERMATH) (Grades K-2)

A comprehensive program in mathematics fundamentals using concrete objects and actual physical operations for initial mathematics instruction. It provides special mathematics emphasis in the earliest grades and increases the number of teachers with a substantive background in mathematics.

Contact: Mary Alice Felleisen, 38 North Waterloo Road, Devon, PA 19333, 215-687-6252.

FISH BANKS, LTD (Grades 9-12+)

A computer-assisted simulation to improve academic achievement and increase communication skills. Conveys factual knowledge about a major environmental issue and motivates students to be informed and effective citizens.

Contact: Karen Burnett-Kurie or Dennis Meadows, Institute for Policy and Social Science Research, Hood House, University of New Hampshire, Durham, NH 03824-3577 603-862-2186.

FOR SEA: INVESTIGATING MARINE SCIENCE (Grades 1-6)

Provides interdisciplinary, activity-oriented, marine education to teach and learn science. Designed to enable students to make responsible decisions about the marine environment.

Contact: Marlene C. Holayer, Assistant Superintendent, Curriculum and Instruction, Olympic Educational Service District 114, 105 National Avenue North, Bremerton, WA 98312, 206-479-0993.

FOUNDATIONAL APPROACHES IN SCIENCE TEACHING: FAST (Grade 7)

A course in the concepts and methods of the physical, biological, and earth sciences and their relation to the environment. Gives students a sense of the operations of the modern scientific community by involving them in typical science activities.

Contact: Donald B. Young, Co-Director, Curriculum Research and Development Group, University of Hawaii, 1776 University Avenue, Room CM117, Honolulu, HI 96822, 808-956-7863, FAX: 808-956-4114.

GEOLOGY IS (Grades 9-12)

An introductory geoscience course to promote wise use of the earth's resources. Promotes awareness and understanding of geoscience processes, making students more responsible consumers of earth materials and protectors of the environment.

Contact: Rion D. Turley, O'Fallon Township High School, 600 South Smiley, O'Fallon, IL 62269, 618-632-3507.

HANDS-ON ELEMENTARY SCIENCE (Grades 1-5)

An instructional program intended to provide elementary students with hands-on experiences emphasizing the processes of science as an approach to problem solving. Increases the amount of science taught and the proportion of instruction dedicated to science processes.

Contact: Helen G. Herlocker, Dissemination Center for Hands-On Elementary Science, Carroll County Public Schools, P.O. Box 661, Hampstead, MD 21074, 410-374-1358, FAX: 410-239-4373.

HELP ONE STUDENT TO SUCCEED (HOSTS) MATH (Grades 1-8)

A diagnostic-prescriptive approach moving at-risk students through a precise sequence of mathematics skills. Encourages the use of manipulatives to develop mental math, problem solving, and higher order thinking.

Contact: William E. Gibbons, Chairman, 8000 NE. Parkway Drive, Suite 201, Vancouver, WA 98662-6459, 206-260-1995.

HIGH/SCOPE K-3 CURRICULUM (Grades K-3)

A method for organizing and managing classrooms and instructional activities to help at-risk students improve their school achievement and literacy skills by giving them opportunities to engage in learning activities that contribute to their cognitive, social, and physical development.

Contact: A. Clay Shouse, Director, Development and Services, High/Scope Educational Research Foundation, 600 North River Street, Ypsilanti, MI 48198, 313-485-2000, FAX: 313-485-0704.

INDIVIDUALIZED PRESCRIPTIVE ARITHMETIC SKILLS SYSTEM (IPASS) (Grades 5-6)

A criterion-referenced testing and instructional program in basic mathematical skills using micro-computers. Can be used as a supplement to most mathematics curricula without modification.

Contact: Robert R. Reynolds, Director, IPASS, Pawtucket School Department, Park Place, Pawtucket, RI 02860, 401-728-2120.

INFORMAL SCIENCE STUDY (IFSS) (Grades 5-12)

A series of physical science mini-units for all students based upon students' recall and use of popular amusement park rides, sports, and playground experiences. Provides an introduction and review or application of both science and mathematics in non-technical language.

Contact: Howard Jones, Director, or Stephanie Hendee, National Training Network 500 Coffman, Suite 204, Longmont, CO 80501, 800-659-5004 or 303-651-0833, FAX: 303-651-1044.

INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS (Grades 5-8)

An interdisciplinary and action curriculum focused on enhancing students' responsible behavior through the examination and evaluation of real life community-based environmental problems and issues.

Contact: Stephanie Hendee, Director, National Training Network, 500 Coffman, Longmont, CO 80501, 800-659-5004. Trudi Volk, Southern Illinois University, Carbondale, IL 62901, 618-453-4214. John M. Ramsey, University of Houston, Houston, TX 77204, 713-743-4966.

IOWA CHAUTAUQUA PROGRAM (ICP) (Grades K-12)

An inservice model for improving science teachers and science education programs. Strives to empower science teachers to make science more meaningful and useful for their students.

Contact: Robert E. Yager, Director, Science Education Center, The University of Iowa, Iowa City, IA 52242, 319-335-1189.

JEFFCO MIDDLE SCHOOL LIFE SCIENCE PROGRAM (Grades 7-8)

A program enabling students to understand the human body, basic ecological principles, and issues associated with environmental problems. Integrates lab activities and readings and includes topics identified by teachers and experts in middle school science curriculum.

Contact: Harold Pratt, Jefferson County Public Schools, 1829 Denver West Drive, Building 27, Golden, CO 80401, 303-273-6561.

KEYBOARDING, READING, AND SPELLING (KRS) (Grades 1-7)

A program that teaches students to use a microcomputer keyboard to learn to type, read, and spell. Uses a phonetic approach to reading and provides opportunities for students to master skills through reinforced practice.

Contact: Ethna R. Reid, Reid Foundation, 3310 South 2700 East, Salt Lake City, UT 84109, 801-486-5083 or 801-278-2334.

KINDERGARTEN INTEGRATED THEMATIC EXPERIENCES (KITE) (Grade K)

A program to increase reading and mathematics achievement by promoting basic reading and mathematics readiness and language skills while helping children develop a positive self-image. Assists teachers in moving from traditional toward developmentally appropriate practices.

Contact: Jeanne Stout Burke, Director KITE, Sunshine Gardens School, 1200 Miller Avenue, South San Francisco, CA 94080, 415-588-8082.

LIFE LAB SCIENCE PROGRAM (Grades 2-6)

An applied science program emphasizing a hands-on, garden-based "living laboratory" approach to elementary science. Improves student attitudes toward the study of science and increases students' level of knowledge and skill acquisition in science.

Contact: Lisa Glick or Gary Appel, Life Lab Science Program, 1156 High Street, Santa Cruz, CA 95064, 408-459-2001, FAX: 408-459-3483.

MARINE SCIENCE PROJECT: FOR SEA (Grades 7-12)

A comprehensive, activity-oriented, marine science curriculum that teaches basic science skills and knowledge on or away from the coast. Designed to equip students with information necessary to make responsible decisions about the marine environment.

Contact: Marlene C. Holayer, Assistant Superintendent, Curriculum and Instruction, Olympic Educational Service District 114, 105 National Avenue North, Bremerton, WA 98312, 206-479-0993.

MATHEMATICS ACHIEVEMENT PROGRAM (Grades 3-5)

A pull-out remedial mathematics program to help students overcome difficulties in computation concepts and application skills. A cooperative program between the regular classroom teacher and the Chapter 1 teacher.

Contact: John W. Williams, Mathematics Achievement Program, Chester Upland School District, 18th and Melrose Avenue, Chester, PA 19013, 610-447-3860.

MATHEMATICAL ACHIEVEMENT THROUGH PROBLEM SOLVING (MAPS) (Grades 5-9)

A complete 1-year curriculum to increase the problem-solving ability and the conceptual understanding of mathematics in general mathematics students. Students build conceptual frameworks while they are engaged in activities.

Contact: Jean Boddy, Mathematics Education Specialist, Department of Curriculum and Instruction, 1442 Engineering Administration building, Purdue University, West Lafayette, IN 47907-1442, 317-494-0803.

MECHANICAL UNIVERSE: HIGH SCHOOL ADAPTATION (Grades 9-12)

A series of 28 high school-level study modules for teachers and students to reinforce the major topics and concepts covered in most physics textbooks. Incorporates visual images in a historical context to enhance students' understanding of high school physics.

Contact: Richard P. Olenick, Department of Physics, University of Dallas, 1845 East Northgate Drive, Irving, TX 75062-4799, 800-526-8472.

MORE EFFECTIVE SCHOOLS/TEACHING PROJECT (Grades 1-12)

A program to increase academic achievement for all students and to improve the organization and delivery of instruction in schools throughout a district.

Contact: Robert Sudlow, Spencerport Central Schools, 71 Lyell Avenue, Spencerport, NY 14559, 716-352-0603.

NATIONAL FACULTY TEACHING PROJECT (Grades 1-12)

A program to strengthen the quality of instruction by encouraging professional growth among teachers and increasing knowledge of disciplines. Teachers collaborate with a national faculty to develop a unique program for their school.

Contact: Andrea Fowler, The National Faculty, Healy Building, Suite 300, 57 Forsyth Street, Atlanta, GA 30303, 404-525-0525.

PABLO PYTHON LOOKS AT ANIMALS (Grades K-3)

An introductory science curriculum for children of all ability levels combining classroom instruction and the scientific resources of zoos to teach fundamental science skills. The multimedia approach encourages children to explore the world using all their senses.

Contact: Annette Berkovits, Director of Education and Program Director or Julie Gantcher, Program Dissemination Coordinator, Bronx Zoo, 185th Street and Southern Boulevard, Bronx, NY 10460, 718-220-5135, 718-220-5131, or 800-937-5131.

PHYSICS RESOURCES AND INSTRUCTIONAL STRATEGIES FOR MOTIVATING STUDENTS (PRISMS) (Grades 10-12)

A comprehensive physics program that stimulates students to develop reasoning and problem-solving skills. Blends exploratory activities, concept development, and application activities into a learning cycle.

Contact: Roy D. Unruh, PRISMS, Physics Department, University of Northern Iowa, Cedar Falls, IA 50614, 319- 273-2380. Tim Cooney, Earth Science Department, University of Northern Iowa, Cedar Falls, IA 50614, 319-273-2918.

PHYSICS - TEACH TO LEARN (Grade 12)

A program using computer simulations of the physics concepts that are the most difficult to teach. Simulations require learners to make judgments based on experience or observation about physical events.

Contact: Pamela Williams, Director, or Charles Schleiden, Disseminator, L.A.U.S.D./Physics-Teach To Learn, Bell High School, Bell, CA 90201-3201, 213-773-2408 or 560-1800, FAX: 213-560-7874.

POLAR REGIONS (Grades 5-8)

An innovative, interdisciplinary science program for middle grade students emphasizing an investigative and problem-solving approach to the study of meteorology, oceanology, geology, and exploration of the earth's Arctic and Antarctic regions. Students develop and apply critical thinking skills and perform laboratory activities to reinforce scientific concepts.

Contact: Donnalyn Jaque-Anton, L.A.U.S.D., Director of Professional Development, 450 North Grand Avenue, Los Angeles, CA 90012 or Milton Anisman, Disseminator, Environmental Science Center, 6625 Balboa Boulevard, Van Nuys, CA 91406, 818-997-2389.

PRECISION TEACHING PROJECT (Grades K-4)

A model to remediate and build basic skills in math, reading, and spelling by setting performance aims, practice sessions, continuous measurement, and data-based decisions. Can be used to monitor and make decisions with any teaching technology, methodology, or style.

Contact: Ray Beck, Project Director, Precision Teaching Project, Sopris West, Inc, P.O. Box, 1809, Longmont, CO 80502-1809, 303-651-2829.

PROJECT CAREER AWARENESS PROGRAM (PROJECT CAP) (Grades K-6)

A program for infusing career awareness into the regular curriculum, emphasizing the relationship between careers and basic academic skills. Introduces students to the wide variety of ways in which people work.

Contact: Lena Sparkman, Coordinator Project Career Awareness Program, Boston Mountain Educational Cooperative, P.O. Box 13, Greenland, AR 72737, 501-443-3336.

RELATIONSHIPS AND MATH-FRIENDLY PHYSICAL SCIENCE (RAMPS) (Grades 8-9)

A one-year physical science program to enable students to use and understand equations as they apply to science and to use this knowledge to do mathematical problem solving. Fosters the perception that mathematics is a useful aid to understanding science.

Contact: Madeline P. Goodstein, RIMAK Educational Foundation, P.O. Box 701, Devon, PA 19333, 610-687-6252.

SAVE FOR AMERICA (Grades 4-6)

A program to teach students basic principles of personal economics during social studies and to help them practice their skills by participating in a school-based program. The program's purpose is to reinstitute the savings habit in young people.

Contact: Sherry Avena, 4095 173rd Place, SE, Bellevue, WA 98008, 206-746-0331, FAX: 206-562-8780.

SCIENCE-TECHNOLOGY-SOCIETY: ISSUES AND SOLUTIONS (STSIS) (Grades 6-8)

A semester curriculum that focuses on the interrelationships among science, technology, and society and on the skills needed for the investigation, evaluation, and citizenship responsibilities associated with science-related social issues. Provides training for students to become scientifically literate citizens.

Contact: Harold Hungerford or Trudi Volk, Science and Environmental Education Center, Department of Curriculum and Instruction, Southern Illinois University, Carbondale, IL 62901, 618-453-4211 or 618-453-4214.

SCIENCE-TECHNOLOGY-SOCIETY: PREPARING FOR TOMORROW'S WORLD (PFTW) (Grades 7-12)

A multidisciplinary approach to problem solving and critical thinking to promote skills needed to deal with issues in science, technology, and society. Enables students to deal effectively with complex current and future social issues.

Contact: David Lidstrom, 1140 Boston Ave., Longmont, CO 80501, 303-651-2829 FAX: 303-776-5934.

SCI-MATH (Grades 7-12)

A curriculum model bridging the abstract operations taught in mathematics and their applications in the introductory sciences. Enables students to build a set of problem-solving and reasoning strategies they can apply in many settings.

Contact: Kirsti Aho or Carolyn Hubachek, Co-Directors, Sci-Math, Education and Technology Foundation, 4655 25th Street, San Francisco, CA 94114, 415-824-5911, FAX: 415-282-4294.

SKILLS REINFORCEMENT PROJECT (SRP) (Grades 5-7)

A program to improve the reasoning ability and mathematics achievement of talented minority and low-income students. Allows students to proceed at a flexible pace as new concepts and skills are mastered.

Contact: Ms. Elizabeth Stork, Skills Reinforcement Project, Center for Talented Youth, Johns Hopkins University, 520 East Wilson Avenue, Suite 120, Glendale, CA 91206, 818-500-9034, FAX: 818-500-9058.

SOUND FOUNDATIONS (Grades 7-12)

A program to improve the achievement and attitude of high school remedial mathematics students by presenting concepts through topics of interest to the age level. Students participate in a job simulation about a rock band, learning new mathematics topics as they are needed in the simulation.

Contact: Dr. Robert Gerver, North Shore High School, 450 Glen Cove Avenue, Glen Head, NY 11545, 516-671-5500.

STARWALK (Grades 2-5)

A comprehensive earth-space science program for elementary students. Before and after classroom lessons and activities are structured around visits to a planetarium facility.

Contact: Bob Riddle, Starwalk, Southwest Science/Math Magnet High School, 6512 Wornall Road, Kansas City, MO 64113, 816-871-0913.

STONES AND BONES (Grades 7-12)

A laboratory approach to the study of biology, general science, and anthropology to enrich present courses. Emphasizes active student participation through laboratory explorations.

Contact: Donnalyn Jaque-Anton, Los Angeles U.S.D., Director of Professional Development, 450 North Grand Avenue, Los Angeles, CA 90012. Milton Anisman, Disseminator, Physical Anthropology Center, 6625 Balboa Boulevard, Van Nuys, CA 91406, 818-997-2389.

SUCCESS UNDERSTANDING MATHEMATICS (SUM) (Grades 2-6)

A comprehensive mathematics program for students of all ability levels using concrete objects and questioning techniques to increase achievement of those performing below expectations. Program may be used with any text or matched to any student needs.

Contact: Kathleen Bullington, Director, Success Understanding Mathematics, Des Moines Public Schools, 1800 Grand Avenue, Room 343, Des Moines, IA 50309, 515-242-7860, FAX: 515-242-7550.

SUCCESSFUL INTERVENTION THROUGH TURNKEY EDUCATION (SITE) (Grades 2-6)

An inservice program for elementary school teachers and supervisors for the development of higher level thinking skills through the use of manipulative materials. Uses processes and activities that are immediately applicable in the classroom and integrated into the existing math curriculum.

Contact: Dr. Barbara Berman or Dr. Fredda J. Friederwitzer, Co-directors, SITE, Educational Support Systems, Inc., 446 Travis Avenue, Staten Island, NY 10314 718-698-3636, FAX: 718-370-3102.

SYSTEMATIC TEACHING AND MEASURING MATHEMATICS (STAMM) (Grades K-8)

A comprehensive, outcome-based mathematics program resulting in high student achievement. Covers the elementary curricula and presents the means necessary to assist in delivering NCTM's "Standards."

Contact: Larry Bradsby, Director, STAMM, Jefferson County Schools, 1725 South Wright Street, Lakewood, CO 80228, 303-273-6630.

SYSTEMS APPROACH TO INDIVIDUALIZED INSTRUCTION (SAII) (Grades 1-6)

A systematic instructional program in reading and mathematics. The program includes tests and learning modules for 155 reading skills and for 200 computational skills in mathematics, as well as sets of questions and worksheets for over 400 paperback books.

Contact: Charles L. Baker, Josephine County School District, P.O. Box 160, Murphy, OR 97533, 503-862-3111.

TEAM ACCELERATED INSTRUCTION (TAI): MATHEMATICS (Grades 3-6)

A program using group instruction that improves motivation toward mathematics by meeting the diversity of student needs within the classroom. Combines interactive instruction with cooperative learning to accelerate student achievement.

Contact: Barbara M. Luebbe, Director, TAI: Mathematics, Center for Social Organization of Schools, The Johns Hopkins University, 3505 North Charles Street, Baltimore, MD 21218, 410-516-0370.

TITLE I MATHEMATICS COMPUTER ASSISTED INSTRUCTION (CAI) (Grades 3-6)

A diagnostic-prescriptive, pull-out mathematics program with students receiving 10 minutes of daily concentrated drill. Adjusts instructions to the level of the students and provides immediate feedback to them.

Contact: John E. Martin, Supervisor, Federally Supported Programs, Lafayette Parish School Board, P.O. Drawer 2158, Lafayette, LA 70502, 318-236-6907.

UTILIZING COMPUTERS IN TEACHING SECONDARY MATHEMATICS (UCTSM) (Grades 9-12)

A program of microcomputer-based instructional materials and techniques to improve mathematics skills. Computer programs include tutorials, drill and practice, and simulations.

Contact: Monika Steinberg, Director, UCTSM, Educational Information and Resource Center (EIRC), 606 Delsea Drive, Sewell, NJ 08080, 609-582-7000, FAX: 609-582-4206.

VIDEODISC-BASED INSTRUCTION IN CORE SCIENCE CONCEPTS (Grades 8-12)

An instructional system using videodisc technology to enhance science teachers' ability to reach diverse learners. Using the technology, teachers engage students in discussion, demonstration, and individual work to learn earth science and chemistry content.

Contact: Alan Hofmelster or Judy Fifield, Technology Division, Center for Persons with Disabilities, Utah State University, Logan, UT 84322-6800, 801-750-3718.

WILDLIFE INQUIRY THROUGH ZOO EDUCATION (W.I.Z.E.) (Grades 7-9)

A life sciences program using zoo resources to improve understanding of concepts related to population, ecology, wildlife conservation, and species survival. Teaches that animals are members of populations that interact with one another and ecological processes affecting animals also affect humans.

Contact: Annette Berkovits, Director of Education and Director of W.I.Z.E. or Donald Lisowy, W.I.Z.E. Dissemination Coordinator, Bronx Zoo, New York Zoological Society, 185th Street and Southern Boulevard, Bronx, NY 10460, 718-220-5135 or 800-937-5131.

ZOO OPPORTUNITIES OUTREACH (ZOO) (Grades K-6)

A series of curriculum materials related to the study of animals to supplement and enrich existing classroom programs through experiential learning. Students experience not only science, but also aspects of language, mathematics, social studies, music, and art.

Contact: Steve Binkley, Carolina Biological Supply Company, 2700 York Road, Burlington, NC 27215, 919-584-0381.

Educational Programs that Work

Educational Programs That Work is a publication which gives an overview of all educational programs approved for national dissemination by the U.S. Department of Education, including programs mentioned in this section. It provides basic information on exemplary programs and services across curricular areas and specialized audiences. For more information, or to order *Educational Programs That Work*, call Sopris West at 1-800-547-6747.

THE EISENHOWER NATIONAL CLEARINGHOUSE FOR MATHEMATICS AND SCIENCE EDUCATION

THE EISENHOWER NATIONAL CLEARINGHOUSE FOR MATHEMATICS AND SCIENCE EDUCATION

The Eisenhower National Clearinghouse for Mathematics and Science Education (ENC) is funded through the U. S. Department of Education to provide K-12 teachers with a central source of information on mathematics and science curriculum materials. ENC was established in 1992 through a contract with The Ohio State University and is located in Columbus, Ohio.

The purpose of the Eisenhower National Clearinghouse is to encourage the adoption and use of K-12 curriculum materials and programs which support state and national efforts to improve teaching and learning in mathematics and science. It provides better access to resources by creating, maintaining, and cataloging a comprehensive, multimedia collection of materials and programs. The ENC catalog and other products are distributed nationally using both traditional formats and advanced computing and telecommunications technologies. Specifically, ENC provides the following products and services:

- A catalog of mathematics and science curriculum materials from federal government agencies and many other sources. The cataloged materials include print, other media (e.g., video, audio, graphic images, and software), kits, and online electronic resources. Catalog entries include a wealth of information, such as an abstract, cost of the item, and information on availability. The catalog database is available online via Internet and a toll-free number and, beginning in fall 1995, on CD-ROM.

- A Digital Curriculum Lab at ENC's online information service through which users can readily access a variety of Internet resources, including a database of Federal programs serving mathematics and science education, the ENC catalog of curriculum materials, resources from other education databases, and information and materials on education reform.

- A repository of curriculum materials in Columbus, Ohio, for educators and others to examine the complete ENC collection and a smaller repository, the Capital Collection and Demonstration Site, in Washington, DC, at George Washington University.

- A variety of print materials including topical catalogs on selected materials in the ENC collection, information about federal programs serving mathematics and science education, informational materials about ENC, and materials about reform in mathematics and science education.

- Twelve demonstration sites are located in conjunction with the ten Eisenhower Regional Consortia, the Capital Collection & Demonstration Site, and at ENC. Demonstration sites provide both the opportunity for users to preview the ENC online information service and a variety of software and other materials available at each site.

- Beginning in 1995, two CD-ROM collections per year. One will include materials that support education reform, such as curriculum frameworks and information on standards, assessment and professional development, and the second will make print and software curriculum materials available for classroom use. Each disk will also include the complete ENC catalog and an Internet directory which can be used to demonstrate the benefits of Internet access.

Access to ENC Online

The ENC online information service includes the electronic catalog of mathematics and science curriculum materials and a set of Internet resources for K-12 teachers. With a computer and a modem or Internet access, anyone can use ENC Online.

Internet:

With an Internet connection, use the telnet command to connect to **enc.org** and login as **guest**. It is also possible to connect to ENC at **enc.org** using Gopher software or at **http://www.enc.org** using World Wide Web software. If connecting through Gopher or World Wide Web, a login is not necessary.

Modem:

With a modem, dial **800-362-4448** for toll-free access. (Although not a toll-free call, 614-292-9040 also provides access.) Set communication software to:

VT100 terminal emulation

No parity, 8 data bits, 1 stop bit.

Once connected, press <RETURN> or <ENTER> once to bring up a screen and type **c** to begin. Login as **guest** as though using telnet.

Other Access:

Some Free-Nets and nationwide commercial networks, such as America Online, provide access to the ENC catalog. Contact the help desk of local networks for more information.

How to Login to ENC

If dialing in or using telnet to access ENC, always login at the first screen as **guest**, even after registering a username. The first time a user connects to the ENC catalog, the screen prompts users to type **new** and then to supply some basic information which enables ENC to provide users with additional information about its products and services. A username is assigned based upon last name and telephone number, and the screen reminds users what to supply for subsequent connections. If connecting through Internet or other access which supports Gopher, no username is required. All the information needed to search the ENC Catalog of Curriculum Materials is available on the screen after logging in.

For Additional Information About ENC:

General Information

Toll-Free Telephone:	800-621-5785
Telephone:	614-292-7784 (voice)
E-mail:	info@enc.org
Fax:	614-292-2066
Hours:	Monday - Friday 8 A.M. - 5 P.M. (EST)

Technical Help Desk

Telephone:	614-292-9590 (voice)
E-mail:	help@enc.org
Fax:	614-292-2066
Hours:	Monday - Friday 9 A.M. - 9 P.M. (EST) Saturday - 12 P.M. - 5 P.M. (EST) Sunday - 5 P.M. - 10 P.M. (EST)

Reference Desk

Telephone:	614-292-9734 (voice)
E-mail:	library@enc.org
Fax:	614-292-2066
Hours:	Monday 1 P.M. - 6 P.M. (EST)
	Tuesday - Wednesday 1 P.M. - 8 P.M. (EST)
	Thursday - Saturday 1 P.M. - 6 P.M. (EST)

Mailing Address

Eisenhower National Clearinghouse for Mathematics and Science Education
The Ohio State University
1929 Kenny Road
Columbus, OH 43210-1079

Do you know of any Promising Practices?

The Eisenhower National Clearinghouse is looking for promising practices in mathematics and science education and other classroom materials that are useful to educators.

What resources does the Clearinghouse collect?

- Printed documents include curriculum materials, activity guides, teacher and student guides, sourcebooks, reference materials, textbooks, program descriptions and reports, published articles, directories, bibliographies, and technical information about instructional equipment.
- Magnetic and optical media include software, images (GIF, JPEG, EPS, etc.), CD-ROM, Optical Discs, Laser Discs, Videotapes, and Audio Tapes.
- Projected media include films, slides, filmstrips, overhead transparencies, microfiche, and microfilm.
- Real objects include kits, manipulative materials, microcomputer based packages and probeware, instructional models, games and simulations, assorted instructional aids (posters, maps, charts, etc.), and laboratory or field equipment.
- Virtual resources available on the Internet, such as Gopher sites, World Wide Web pages, WAIS indexes, ftp sites, listserv archives, and FAQ files.

Why should I submit materials to ENC?

ENC is designed to be the logical starting point for anyone looking for science and mathematics curriculum materials. Users of ENC services include:

- Teachers of grades K-12 who are looking for quality materials for their mathematics and science classrooms.
- Library and media specialists who are searching for materials for clients and becoming aware of available services.

What information about resources will ENC users actually see?

The catalog includes information such as author, title, subject, publisher, appropriate grade levels, type of material, price, availability, and an abstract. For many items, users will also be able to explore evaluations of materials, examine samples of documents, link to full text documents or images, and link to other databases.

How do I submit materials to ENC?

The procedure for submitting materials to the Clearinghouse is simple. Submit two copies of your original material in appropriate packaging to the Acquisitions Coordinator at the Clearinghouse with an ENC Submission Form. A copy of the submission form is found on page 163. These forms will give ENC information necessary to process your item.

The ENC Submission Form includes a page about copyright permissions. When you fill out this page, you can grant permission to ENC to distribute or display parts of copyrighted materials. You determine how much, if any, of your materials ENC may use in the catalog. Note also that you can grant copyright permissions only for those materials you have created.

Can I suggest resources produced by other people?

If you know of valuable materials for mathematics and science teachers, we'd like to know about them, too. Fill out an ENC Suggestion Form or contact the Acquisitions Coordinator and mention the items you would like to see in the collection. Please try to give us as much information about the item as possible to help us find the materials.

Items that you suggest may also be Internet resources. We actively seek information available on the Internet such as gopher sites where educational materials are stored. If you find one, please let us know.

How are ENC resources chosen?

Availability information is essential for the acceptance of resources into ENC. Most resources must be available to educators commercially, from a professional organization or from some other commonly recognized source. ENC is also interested in making certain items available through the Clearinghouse, if these would be difficult for teachers to obtain elsewhere.

Items submitted for inclusion in the ENC collection are examined using the following criteria to determine if they fit within the scope of ENC activities:

- Subject Matter: All items selected must be in the domains of mathematics or the natural sciences, pure or applied.
- Grade Level: All items selected must be useful in supporting instruction in grades K-12.
- Nature and Scope of Resource: Most accepted resources will fall into one of four categories:

    1. Instructional plans
    2. Instructional resources
    3. Supplemental resources
    4. Evaluative resources

What happens to an item after it is selected for ENC?

- A new item is first prioritized, based on quality indicators such as content, goals, teaching strategies, and activities. The primary focus is to get high quality materials that support national standards into the catalog quickly.
- An abstract is written for the resource.
- A full catalog record is created and entered into the online catalog.
- Additional materials associated with the cataloged item are prepared, such as sample pages, full text files, and linkages to other files.

Once an item becomes a part of the ENC catalog, the Clearinghouse actively solicits evaluations of the materials and users are encouraged to provide comments.

What happens to materials not selected for ENC?

- With prior agreement ENC will return materials submitted for consideration.
- Materials inappropriate for ENC may be of interest to the ERIC Clearinghouse for Science, Mathematics, and Environmental Education, and may be forwarded to them.
- Resources which cannot be processed or returned or are not appropriate for ENC or ERIC will be discarded.

While ERIC and ENC are both information services for education, their emphases differ. ERIC focuses primarily on research materials for all levels of education, while ENC collects curriculum materials for grades K-12.

If you have additional questions, please contact us:

Acquisitions
Eisenhower National Clearinghouse
1929 Kenny Rd
Columbus, OH 43210-1079

Phone: 614-292-8389 Fax: 614-292-2066
Internet E-mail: submit@enc.org

☆ U.S. GOVERNMENT PRINTING OFFICE. 1995 — 606 - 050

EISENHOWER NATIONAL CLEARINGHOUSE for MATHEMATICS AND SCIENCE EDUCATION

ENC Materials Submission Form

All items must be received in usable form; items will not be repaired or otherwise modified to render them usable or operable.

ENC Number

Please provide all information as it should appear in the ENC records. If the requested information is not available or does not apply to the material you are submitting, please indicate "NA". Please provide full names (no acronyms) of all individuals, institutions, and/or agencies.

Complete one form for each individual item or series of items that you submit to the Eisenhower National Clearinghouse. Please note only one form is needed for a series if you clearly identify the items in that series. Please allow 6-8 weeks for acknowledgment of your submission.

A

Item or Series Title _____

Date Published _____

If this item or series has multiple components, please attach a listing of the items included with this submission or attach a product description sheet or catalog page and clearly indicate the items included in this submission.

B

Submitter's Name _____ (First) _____ (MI) _____ (Last) Dr. Mr. Ms. Mrs. (Circle one)

Company or Organization _____

Address line 1 _____

Address line 2 _____

Title _____

City _____ State _____ Zip _____ - _____ Country _____

Telephone _____ 1-800 _____

Fax _____

Email _____

C

If you are NOT the vendor or publisher of the item submitted, please fill out this section, otherwise go to section D.

Vendor or Publisher _____

Contact Name _____ (First) _____ (MI) _____ (Last) Dr. Mr. Ms. Mrs. (Circle one)

Company or Organization _____

Address line 1 _____

Address line 2 _____

Title _____

City _____ State _____ Zip _____ - _____ Country _____

Telephone _____ 1-800 _____

Fax _____

Email _____

D

If you are NOT the author or developer of the item submitted, please fill out this section, otherwise go to section E.

Author(s) or Developer(s) _____

Contact Name _____ (First) _____ (MI) _____ (Last) Dr. Mr. Ms. Mrs. (Circle one)

Company or Organization _____

Address line 1 _____

Address line 2 _____

Title _____

City _____ State _____ Zip _____ - _____ Country _____

Telephone _____ 1-800 _____

Fax _____

Email _____

Copyright Permissions Granted the Eisenhower National Clearinghouse

Permissions granted do not determine inclusion into the ENC catalog.
Materials created by federal employees as part of their jobs are generally not copyrightable.

E *Items in the public domain my be reproduced and/or distributed in part or whole by ENC. No further permissions are needed.*

If this item is in the public domain, INITIAL here, otherwise place NO here: ☐

If you initialed this box, skip to section J

F *If your organization has an ENC Standing Submissions Agreement, your submission can be processed using that agreement.*

If you want this item processed using a standing agreement, INITIAL here, otherwise place NO here: ☐

If you initialed this box, skip to section J

G *So users may better judge the appropriateness of your materials, ENC would like to include a selection of samples drawn from your submission as part of its electronic, print, and on-line catalog records. ENC needs permission to do so. To include a specific sample in the ENC catalog, place your INITIALS in the appropriate box . Write NO to exclude the sample.*

ENC may include samples selected by ENC not to exceed _____% of the total submission. ☐

ENC may include the table of contents and/or menu screens. ☐

ENC may include preface or introductory materials. ☐

ENC may include a text sample not to exceed 5 pages in length. ☐

ENC may include a video clip not to exceed 2 minutes ☐

INITIAL if specific directions for sampling are provided on a signed and dated attachment. Indicate NO if no such directions are provided. Use this permission if you are including a demonstration program, video clip, or other specific samples.

See the signed and dated attachment to this submission form for specific sampling instructions: ☐

H *If you want ENC to duplicate and distribute the ENTIRE item submitted your permission is needed. INITIAL the box below to indicate permission is granted or write NO to deny permission. Please note that providing permission to ENC to duplicate and distribute an item does not commit ENC to do so. Also note that distribution may occur using on-line and Internet resources, as a component of electronic products such as video tape, CD-ROM, laserdisc, etc., or in print format.*

I grant ENC permission to duplicate and distribute this entire item or series in any manner appropriate: ☐

I *Indicate if you wish the permissions given on this form to apply to all future submissions as a Standing Agreement.*

INITIAL here to initiate a Standing Agreement, write NO if you do not want such an agreement. ☐

J **The submitter represents and warrants that, except as specifically noted on attachment(s) to this Submission Form, the above permissions include any copyrighted material from other sources contained in any item(s) covered by this agreement. The entity on whose behalf this agreement is signed represents and warrants that no item(s) will be submitted on its behalf under this agreement for which it does not then have the right to grant all of such permissions.**

Submitter's Name _____ (First) ___ (MI) _____ (Last) Dr. Mr. Ms. Mrs. (Circle one)

Company or Organization _____

Address line 1 _____

Address line 2 _____

Title _____

City _____ State _____ Zip ____ - ____ Country _____

Telephone _____ 1-800 _____

Fax _____ Email _____

Please provide an authorized signature here: _____ Date _____

INFORMATION ABOUT THE SUBMITTED ITEM(S)

Please provide as much of the following information as you can. Providing this information assists the Clearinghouse in developing the catalog record(s) for your submission and makes it possible for your submission to be placed in the catalog much more rapidly.

Grade Level:

Please circle the grade levels for which this item is intended:

pre-K K 1 2 3 4 5 6 7 8 9 10 11 12 13 14 Preservice Teachers Inservice Teachers

Sources of Support:

For federally funded items, please provide the Agency Name and the Contract/Grant Number:

For items funded by any other organizations, list the organization or agency that funded the development of the item and provide any additional information you feel is necessary for inclusion in the catalog.

Pricing and Availability:

For items that are available for purchase, please provide pricing and information as to where those items may be purchased. For all items, please provide information detailing how individuals may obtain the items submitted. Feel free to attach catalog pages or promotional flyers containing ordering information.

Reviews and Evaluations:

If applicable, please provide the following information or attach any reviews or evaluations of your materials. Feel free to attach information to the application as necessary.

Third Party Awards
(Provide: awarding organization name; title of award; date conferred; text or comments)

Organizational Reviews
(Provide: organization name; text or abstract of review; where announced or citation information)

Published Reviews and Research Studies
(Provide: publication name; article title; reviewer; date/volume/issue; pagination; ED or EJ number)

Developer Field Test(s)
(Provide: site; date or time period of field test; text or abstract of results; citation)

Special Features:

Please list any features you feel make this item unique or special (50 words or less)

Support of Standards:

If your material relates to specific national or state curriculum standards or frameworks, please identify and describe how it is addressed (50 words or less). If available, provide supporting documentation.

Abstract:

If available, please provide an abstract for items being submitted. Feel free to attach a previously prepared abstract or use the space provided. The abstract you provide will provide ENC staff with the starting point for the development of the abstract and catalog record to be included in the ENC catalog. In some instances, it may used without alteration. In most instances, your abstract will be reviewed and revised to meet the ENC style criteria and the informational needs of the ENC catalog. If you develop an abstract for this submission, you need not devote excessive time and effort in this process. A draft abstract is acceptable.

Acquisitions, Eisenhower National Clearinghouse, 1929 Kenny Road, Columbus, OH 43210-1079
Phone: 614-292-8389 Fax: 614-292-2066 Internet E-mail: submit@enc.org

National Network of Eisenhower Mathematics and Science Regional Consortia and National Clearinghouse

Eisenhower Math/Science Consortium at the Appalachia Educational Laboratory
Appalachia Educational Laboratory
Charleston, WV

Far West Regional Consortium for Science and Mathematics
Far West Laboratory for Educational Research and Development
San Francisco, CA

High Plains Consortium for Science and Mathematics
Mid-continent Regional Educational Laboratory
Aurora, CO

Midwest Consortium for Mathematics and Science Education
North Central Regional Educational Laboratory
Oak Brook, IL

Northwest Consortium for Mathematics and Science Education
Northwest Regional Educational Laboratory
Portland, OR

Pacific Mathematics and Science Regional Consortium
Pacific Regional Educational Laboratory
Honolulu, HI

Eisenhower Regional Alliance for Mathematics and Science Education Reform
Regional Laboratory for Educational Improvement of the Northeast and Islands
Andover, MA

Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education
Research for Better Schools
Philadelphia, PA

SERVE Mathematics and Science Regional Consortium
SouthEastern Regional Vision for Education
Tallahassee, FL

Southwest Consortium for the Improvement of Mathematics and Science Teaching
Southwest Educational Development Laboratory
Austin, TX

Eisenhower National Clearinghouse for Mathematics and Science Education
The Ohio State University
Columbus, OH