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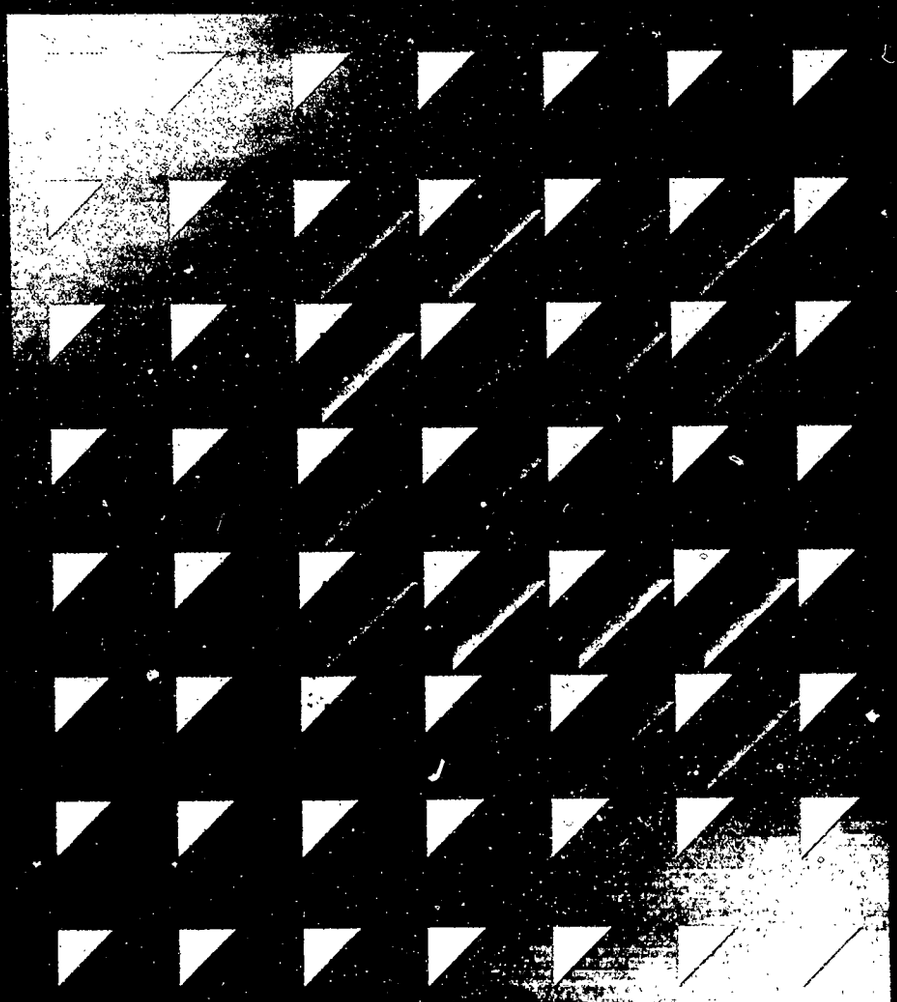
ABSTRACT

The Eisenhower National Clearinghouse for Mathematics and Science Education (ENC) helps teachers by offering a broad assortment of services that enable them to quickly locate educational resources. This document is one in a series of print catalogs designed to give educators information about curriculum resources available for teaching math and science in K-12 classrooms. Each issue of ENC Focus presents a selection of the Clearinghouse collection focused on a topic of particular interest to math and science teachers. This issue features 24 resources that encourage active learning through the use of hands-on materials designed to engage students in "minds-on" active learning. A one-page description of each resource provides: (1) an abstract of the contents; (2) subjects addressed; (3) grade level; (4) publication date; (5) ordering information including price; (6) authors; and (7) related resources. Titles include: "Algebra Tiles for the Overhead Projector," "Inventor's Lab," "Mouse and Elephant: Measuring Growth," and "Using Energy." (JRH)

Issue 2, 1995-96

FOCUS

For Mathem



Dear Math and Science Teachers!

Welcome to *ENC Focus: Active Learning with Hands-On Resources*. This is the fourth issue in a series of print catalogs designed to give educators information about curriculum resources available for teaching math and science in K-12 classrooms. Each issue of *ENC Focus* presents a selection of the Clearinghouse collection focused on a topic of particular interest to math and science teachers. ENC provides teachers information about a cross section of materials in different media or formats and at various grade levels, along with ordering and price information so the materials that are useful can be easily ordered from the publisher.

This issue features those materials that encourage active learning through the use of hands-on materials. Most educators already understand the phrase "hands-on"; more important to this catalog is the philosophy of "minds-on." Please use this catalog to learn more about active learning and materials that encourage it.

The Eisenhower National Clearinghouse for Mathematics and Science Education (ENC) helps teachers by offering a broad assortment of services that enable them to quickly locate educational resources. In addition to these print catalogs, ENC's entire collection is cataloged online in the ENC Resource Finder. The Clearinghouse also houses the national collection of these resources in a permanent repository.

ENC invites teachers to suggest materials for the national collection, submit materials they have developed, and encourage others to access ENC's Resource Finder. In this way teachers can join us in promoting the effective use of technology to share resources with other educators.

Twelve ENC demonstration sites are conveniently located throughout the country so that teachers can learn how to use ENC's online services and preview selected curriculum resources. These sites are generally located in conjunction with the Eisenhower Regional Consortia (see contact names and addresses on the inside back cover of this publication).

A special request:

ENC needs to hear from educators all over the country—what topics in math and science education are important to you? What kinds of resources are you looking for? Please let us know how to best continue to serve the education community.

The Eisenhower National Clearinghouse for Mathematics and Science Education is funded by the U.S. Department of Education, Office of Educational Research and Improvement.

U. S. Department of Education	Office of Educational Research and Improvement	Office of Reform Assistance and Dissemination
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ENC FOCUS: Active Learning with Hands-On Resources

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Contact ENC for general information at the address and phone number above, or e-mail to info@enc.org. For help with our online services, call our technical help desk at (614) 292-9590 or send e-mail to help@enc.org.

To request copies of any issue of the *Focus* series, contact ENC at address above, or send e-mail to focus@enc.org.

Past issues of *ENC Focus* are *Equity in the Classroom: Mathematics and Science Materials and Resources for Elementary Teachers; Earth Day in the Classroom: Mathematics and Science Materials and Resources for Teachers;* and *Real Data Resources for Teachers.*

How to Connect to ENC's Online Services

Educators with an interest in *Focus* topics will find other resources in the online Resource Finder. New records are being added to ENC's catalog daily, so teachers who enjoyed an issue of *Focus* should consult the catalog for newer resources on the same topics. Also, ENC Online provides additional resources and links to other mathematics and science education sites.

To connect to ENC via the Internet, telnet to enc.org; via modem dial (800) 362-4448 or (614) 292-9040. Set your communication software to VT100 terminal emulation, no parity, 8 data bits, 1 stop bit, and full duplex. Once connected, press <RETURN> to bring up a screen and type c to connect. All the information you need to use ENC is on the screen. ENC's World Wide Web address is: http://www.enc.org.

In this issue...

About ENC Focus...

ENC Focus is published periodically by the Eisenhower National Clearinghouse for Mathematics and Science Education, which is funded through Contract No. RP392126001 from the U.S. Department of Education's Office of Educational Research and Improvement (OERI). The ideas and opinions expressed in this publication do not necessarily reflect the positions or policies of the Department of Education or OERI.

ENC Mathematics Advisory Board

ENC Science Advisory Board

Introduction: Active Learning with Hands-On Resources

Consider the following scenario: Basketball season is in full swing, and the players begin practicing for that big game. At the sound of the bell, the team members go to their assigned room, sit in their assigned seats, and proceed to learn anything and everything they can about basketball from their coach, who is lecturing from the front of the room. Players scurry to write down all the details and strategies of the game, and at the end of the lecture they take their manuals home to memorize all that they have learned. Practice is over. As soon as they study some, they will be ready for the big game.

Does that sound strange and foreign to you? When did the players actually get their hands on the basketball and mentally and physically engage themselves in the game? When did their learning take place? The National Council of Teachers of Mathematics (NCTM) and the American Association for the Advancement of Science (AAAS) both create a vision for students to take an active role in their own learning. Whether learning a sport or an academic subject, students still need to explore, justify, predict, synthesize, conjecture, solve, infer, model, and otherwise participate in the learning process. One effective way of encouraging the active involvement of students is to incorporate hands-on activities into classroom teaching.

Active Learning Resources

Resources highlighted in this catalog require students to become actively involved in their own learning. For instance, in *Frog Math: Predict, Ponder, Play*, students estimate how many small plastic frogs are in a jar. They then count the frogs using a place-value board and compare their estimates to the actual count. As a detailed example of how some activities are designed, consider one from the math resource *Mouse and Elephant: Measuring Growth*. Students are introduced to the basic concepts of area and perimeter by using tiles (not included) to represent small tables that form banquet tables. The banquet tables are rectangular arrays and the area is the number of small tables needed to form a banquet table. Perimeter is the number of people who can be seated at a banquet table, knowing that one small table seats four people, or one to an edge. Counting is the most prevalent means of finding measures, and rules are not introduced until a later activity.

Similarly, in *Grow Lab* students investigate the miracle of life from seed to plant by examining some important basic needs that must be met if plants are to thrive and grow. Students observe plant life cycles and discover the structures and processes involved in plant reproduction and explore the tremendous diversity of life. They also investigate how humans use plants, how their actions affect plants, and how they can lessen the negative impact on the "global garden." In *The Mysterious Powder*, students describe, systematically explore, sort, and classify six unknown white powders. Students apply their knowledge of the properties of the powders and of their interactions with other substances to identify the components of a mysterious powder found coating the Dexter School playground. Students also apply their skills and knowledge of scientific procedures to the preparation of household products.

Search Strategies

Resources were selected from ENC's online Resource Finder, our catalog containing thousands of curriculum resources. If you have access to our online services (see How to Connect to ENC on p.1), you may use some of the same searching techniques we used to assemble this catalog. You can search the ENC catalog using a variety of fields, such as cost, grade level, subject matter, or author.

We selected our resources for each page by looking for particular keywords and by limiting searches. We began our searches with the broadest possible terms and then moved to more specific terms. For *Active Learning with Hands-On Resources*, we first did a word search on "hands-on." A word search does not require the restricted vocabulary used in some of the other fields, like subject or resource type, because it searches every field in the catalog record.

Limiting searches is another easy way to find resources that are useful for your classroom. For example, one of our featured resources in this *Focus* is a mathematics manipulative. To find related resources for that page, we limited our search in resource type by the word "manipulatives." Another useful way to find related items is to look at other items in a series.

This catalog is organized alphabetically by title. Each page in the main section of the catalog provides an abstract of a particular resource you may choose to explore. At the top of the page, you will see the suggested grade level for that resource, ordering and price information, and subject identifiers. At the bottom of each page, you will find listings of materials related to the main item, including materials from the same series or items that are the same resource type, such as videos or software. The chart on the following page displays features of the resources for which abstracts are provided.

Active Learning with Hands-On Resources

Overview of Contents

Title	Grade Level	Subject	Cost
The Age of Polymers/Biochemistry	8-12	Science	59.00
Aigebra Tiles for the Overhead Projector	8-12	Math	16.95
Chances Are: Hands-On Activities in Probability and Statistics	3-7	Math	22.00
Connecting Mathematics in the Primary Grades	K-3	Math	415.00
Connections	4	Science	260.00
Dash: Grade K	K	Science	300.00
Exploring Science: Volume 3	3	Science	128.50
Frog Math: Predict, Ponder, Play	K-3	Math	12.50
GrowLab: Activities for Growing Minds	K-8	Science	24.95
How to Use Children's Literature to Teach Mathematics	K-6	Math	3.50
Inventor's Lab	4-6	Science	Free
Investigating Patterns of Change	5-8	Science	98.90
Kindergarten Book	K	Math	9.50
Mathematics Curriculum and Teaching Program	K-10	Math	160.00
Minds-on Science: For Profit, For Planet	5-9	Science	249.95
Mouse and Elephant: Measuring Growth	5-8	Math	15.96
The Mysterious Powder	4-5	Science	65.00
Overhead Math	3-6	Math	90.00
Particles and Prairies: The Fermilab Prairie Savannah	5-8	Science	230.00
Quantitative Literacy: A Non-trivial Art	5-12	Math	8.95
Rocks and Minerals	3	Science	18.95
Soap Films and Bubbles	4-9	Integrated	14.95
Using Energy	8	Science	115.68
Using Live Insects in Elementary Classrooms	K-3	Integrated	15.00

The Age of Polymers/Biochemistry

Grades 8-12

Sunburst/WINGS for Learning
101 Castleton Street, P.O. Box 100
Pleasantville, NY 10570-0100
Toll-free no.: (800) 321-7511
1 videotape package: $59.00
1 complete World of Chemistry set (10 videotapes w/ teacher guides): $495.00

Subjects: *Amino acids; Biochemistry; Chemistry; Enzymes; Plastics; Polymers; Proteins; Real world applications; Science.*

1990

Abstract: These video and print materials, developed by high school teachers with the help of their students, provide a unified framework for the study of chemistry. While viewing the video, students view real world chemistry applications, visit practicing scientists, focus on contemporary issues, and learn about chemistry's history. The contents of the print materials are linked to the video and the concepts are revisited in increasing complexity throughout the 20 modules. The first module of this set, *Polymers*, introduces many of the forms and functions of polymers, describes the raw materials and procedures used to produce them, and describes ways to recycle polymers. Student activities include the preparation of slime and the development of a recycling fair. The second module, *Biochemistry*, describes the function of enzymes, protein chemistry, and the structure and function of proteins. Student activities include investigating what effect some common household chemicals have on the protein in egg whites and building an amino acid model. The print material components include a description of the main concepts in the video; the sequential order of ideas in the video that are coded as real world stories, graphics, historical points, and demonstrations; visual teases that include suggestions for displays; teacher demonstrations; student laboratory experiments; field trip suggestions; the script from the video; suggestions for student research projects; answers to questions students might ask; post video viewing activities; and a student viewing guide. Group activities, writing assignments, and reading lists for students are provided, as well as special drawing activities designed to help students learn to build visual images of the molecular world. (Author/KSR)

Author: *Polymers* adaptation produced, written, and directed by Robert Kaper; *Biochemistry* adaptation prepared by Richard Thomas; executive producer, Richard Thomas; teacher and student materials developed and written by Mary Beth Key, Ron Crampton, Edward Gibb, Carole Goshorn, Cliff Schrader, Patricia Smith

Series: World of Chemistry

Publisher: Annandale, VA: Educational Film Center

Reference no.: ENC-001873

Funding: Annenberg/CPB Project, National Science Foundation (NSF). — Directorate for Science and Engineering Education, Materials Development Program

Evaluation: Citation: "Reviews." *Journal of Chemical Education*, February 1990, Vol. 67, No. 2, p. A54.

Related resources: The *World of Chemistry* series contains several modules for high school students to study chemistry.

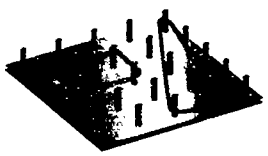
Color/Measurement
The first module in this set, *Color*, introduces students to the methods of science by following the historical development of the use of color in civilization. This module also focuses on the use of color as a tool to understand the molecular world of chemistry. Activities include color and chemical change, acidity and color change, and where dyes come from. The second module, *Measurement*, demonstrates the use of standards to determine precision and accuracy as illustrated in the measurement of chloride concentrations by titration to determine salinity of estuary water and by spectrophotometry to measure mercury concentration.

Algebra Tiles for the Overhead Projector

Grades 8-12

Cuisenaire Company of America, Inc.
10 Bank Street, P.O. Box 5026
White Plains, NY 10602-5026
Toll-free no.: (800) 237-3142
Internet address: info@cuisenaire.com
1 set (with teacher's manual): $16.95
1 tile set (70 tiles): $10.95

Subjects: *Algebra; Manipulatives; Mathematics; Models.*



1994

Abstract: This algebra manipulative set for grades 8 to 12 includes seventy tiles in three different sizes for use with an overhead projector and a teacher's guide. The tiles are concrete models of integers and variables and can be used for exploring the zero principle; operations with polynomials (addition, subtraction, multiplication, and division); factoring; completing the square; and the quadratic formula. Included in the set are red tiles which can be assigned negative values so polynomials with negative terms can be modeled. The purpose of the teacher's manual is to serve as a guide for introducing tiles and integrating their use into a textbook-oriented course of study. Suggestions in the guide draw heavily on the experiences of teachers who have classroom tested this use of tiles for many years. In each of the units in the guide, a concept is introduced on the concrete level and carried through the "draw a picture" and "see a mental image" stages. Specific algebraic examples are given to illustrate the use of the tiles, and student exercises are included to supplement the content of most textbooks when necessary. By using student sets with this overhead set, students can be actively involved in teacher-directed lessons. (Author/MPN)

Author: Cuisenaire Company of America, Inc.; teacher manual, Hilde Howden

Reference no.: ENC-001934

Related resources: Other manipulatives are available to involve students in their own learning.

Reflect-it Hinged Mirror
Cuisenaire Company of America
This resource consists of two mirrors hinged together and a clear plastic base with ten different angle openings. The accompanying activity book with blackline masters looks at everyday objects, such as road signs and pinwheels, in a mathematical way. Math concepts explored include relationships between angle size and number of images, reflections versus reproductions, and the relationship of fractional parts to a whole.

Power Solids
Cuisenaire Company of America
These 12 translucent, plastic geometric solids share a common height to allow students to compare the relationship of the blocks to one another. By removing the lids from the blocks, students fill the different solids with wet or dry material to compare the volume of cones to cylinders, pyramids to cubes, rectangular prisms to cubes, or triangular prisms to hexagonal prisms.

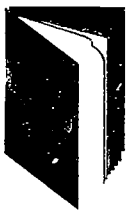
Polyhedra Blocks
Cuisenaire Company of America
This set of three-dimensional blocks uses magnets to allow the blocks to easily connect on related faces. Students use three basic shapes of blocks—triangular pyramids, regular tetrahedrons, and 1/4 octahedrons—to build a variety of simple to complex polyhedra. A set of vinyl faces with reusable adhesive in four colors, activity cards, and a teacher book are included.

Chances Are:
Hands-On Activities in Probability and Statistics

Grades 3-7

Teacher Ideas Press
P.O. Box 6633
Englewood, CO 80155-6633
Toll-free no.: (800) 237-6124
1 text: $22.00

Subjects: *Journal keeping; Manipulatives; Mathematics; Probability; Statistics.*



1995

Abstract: This text is intended for students and teachers in grades 3 to 7 and is designed to provide hands-on experiences in probability and statistics. This book is designed to incorporate recent educational research on curriculum, assessment, and instruction, and to reflect the National Council of Teachers of Mathematics (NCTM) Standards that pertain to probability and statistics. The curriculum and assessment components of this book have been field tested by classroom teachers and include pre-program and follow-up parent surveys. A student self-assessment handout to be used prior to beginning the program is also provided. The activity section includes a teacher's guide, reproducible student activity handouts, reproducible cutout handouts of manipulatives, answer keys, and a glossary of probability and statistics terms. In one of the activities, students use sandwich cutouts (lettuce, bacon, cheese, and bread) to determine the number of different sandwiches that can be made from the ingredients. Many activities provide opportunities for students to use calculators. A student journal provides prompts for students, such as: "after comparing my prediction with the data, I discovered...." In the journal, pages are included for each activity. This program is designed to be compatible with portfolio assessment. (Author/DDD)

Author: Sheila Dolgowich, Helen M. Lounsbury, Barry G. Muldoon

Reference no.: ENC-001798

Standards:
NCTM standards (1989). — Content standards: Grades K-4. Statistics and probability.
NCTM standards (1989). — Content standards: Grades 5-8. Probability.

Related resources: Other resources in the ENC Resource Finder help teach about probability.

Probability Constructor
Program development and design, Zina Feldman, Emil Shenkerman; activities development and design, Miriam Bareket, Gary Brint, Concetta Duval, PRISMA 3D
Logal Software, Inc., East Arlington, MA, Toll-free no.: (800) 564-2587
This computer software program for middle and high school levels with teacher's guide provides a graphic representation of the mathematical theory of probability. The program offers six models, each focusing on a different type of experiment: tossing coins, rolling dice, placing dots in areas, generating numbers, spinning color wheels, and taking marbles out of a jar. Experiment results are displayed using built-in tools such as bar charts, spreadsheets, Venn diagrams, trees, or graphs. The student activities that accompany the program introduce the concepts of frequency and relative frequency.

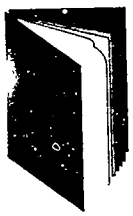
Math Sleuths: Applying Math in Engaging Contexts
Videodiscovery, Inc.
Videodiscovery, Inc., Seattle, WA, Toll-free no.: (800) 548-3472
This videodisc is designed for students in grades 6 to 9 to practice problem-solving skills through real world applications of math. Students use math skills in whole class, small group, or paired settings to solve 10 dramatised mysteries. Designed to reflect NCTM goals, *Math Sleuths* requires students to integrate math, science, research, communication, and writing skills. Students identify the problem to solve; develop a strategy to solve the problem; gather information from the identified clues (interviews, graphs, maps, lab reports, periodical literature, and photographs); and verify the result. Both English and Spanish narrations are available in the videodisc.

Connecting Mathematics in the Primary Grades

Grades K-3

Educational Support Systems, Inc.
446 Travis Ave.
Staten Island, NY 10314
Telephone no.: (718) 698-3636
Training per participant: $95.00
1 starter kit (manipulatives, resource books): $415.00

Subjects: *Arithmetic; Manipulatives; Mathematics; Number concepts; Problem solving; Whole numbers.*



1993

Abstract: Project SITE (Successful Inservice Through Turnkey Education) is a mathematics inservice program that trains classroom teachers and prepares district personnel to become SITE trainers. Designed for grades K to 3, this manual from a Project SITE workshop contains an instructional outline, hands-on activities, and worksheets for teaching various mathematics topics; a collection of materials that describe various teaching strategies (e.g., questioning, use of manipulatives); blackline masters for student activities and instructional materials (e.g., fraction circles); and background information on various instructional and curricular issues (e.g., teaching graphing, ability grouping). Representative instructional activities include games that involve the use of base ten materials to develop the concept of place value; measuring with standard and non-standard units; estimating weights and then checking the estimate using a pan balance; constructing a decimeter cube from construction paper; relating time to fractions using paper folding and Cuisenaire rods; scale drawing; and exploring various methods of determining area using a geoboard (manipulatives not included). (Author/AM)

Author: Fredda J. Friederwitzer, Barbara Berman

Reference no.: ENC-001263

Standards: NCTM standards (1989). — Content standards: Grades K-4. — Mathematics as problem solving; Mathematics as communication; Mathematics as reasoning; Mathematical connection; Concepts of whole number operation; Estimation; Fractions and decimals; Geometry and spatial sense; Measurement; Number sense and numeration; Patterns and relationships; Statistics and probability; Whole number computation.

Related resources: Here are two more resources that use manipulatives for math classes.

Fractions Bars Classroom Management Center
Albert B. Bennett, Jr., Patricia Davidson
Scott Resources, Inc., Fort Collins, CO. Toll-free no.: (800) 289-9299
This kit includes performance objectives, lesson plans, manipulatives, activities, games, worksheets, and tests for teaching fraction concepts and operations to students in grades 2 to 9, as well as a variety of manipulatives including color-coded fraction bars and materials for activities and games.

Geoboards
John Bradford
Scott Resources
This set of instructional materials includes a teacher's guide, an eight-inch wooden geoboard, a set of geoboard activity cards for primary grades, and a set of geoboard activity cards for intermediate grades. The teacher's guide includes suggestions for activities, constructions, and problems for geoboards.

Color Cube Activity Pack: Primary
William J. Masalski
Scott Resources
This activity pack contains a series of 26 colorful, laminated activity cards that involve primary students in manipulating different patterns and configurations of Color Cubes to solve mathematics problems. As students progress through the cards, the skill level increases in difficulty.

Connections

Grade 4

Videodiscovery, Inc.
1700 Westlake Avenue N, Suite 600
Seattle, WA 98109-3012
Toll-free no.: (800) 548-3472
1 teacher's resource guide: $80.00
1 set of 8 student modules: $180.00

Subjects: *Animals; Biological sciences; Botany; Color; Composting; Earth science; Earthworms; Ecosystems; Endangered species; Food webs; Gardens; Habitats; Light; Mathematics; Measurement; Nutrients; Physical properties; Physical sciences; Plant growth; Plants (Botany); Process skills; Recycling; Science; Seeds; Water; Water cycle.*

1994

Abstract: *Life Lab* is an interdisciplinary program of life, earth, and physical sciences in which students learn science concepts by building tools, testing ideas, and watching changes in the world around them. A class garden and hands-on activities form the core of the program, encouraging students to cooperatively investigate life cycles, weather, animals, habitats, and more. The unifying theme for this year long grade 4 curriculum is interactions. By using the garden as a model of an ecosystem, students investigate the impact of water, nutrients, and light on the parts of the garden system. They further explore interactions in this ecosystem model by investigating food webs and by learning how to apply the model to other ecosystems. Students also realize the importance of conserving and recycling and are offered the opportunity to adopt an endangered species and to investigate the ecosystem in which it lives. The grade 4 curriculum is divided into eight units that are separately packaged as modules to increase the flexibility of use. Each of the eight modules is divided into a teacher's resource section an l a student's lab book section. The teacher's resource section includes a unit planner; a list of student goals that summarizes the theme, skills, and concepts developed for the unit; the words and score to an ecologically-oriented song; an activity chart; an annotated bibliography of story and reference books; a parent letter; blackline masters; an endangered species project section; and an assessment checklist. The resource section also includes the following for each activity: a key learning goal, background information, where the activity can be integrated into the curriculum, process skills used in the activity, a materials list, pre- and post-activity assessment strategies, extension ideas, and teacher reflection questions. The student lab book section includes pre- and post-activity assessment lab sheets that allow students to diagnose their own learning, lab handouts, unit calendars for students to use as a recording and observation tool, field log sheets, and background information and engaging stories related to each unit's concepts. A separate teacher's guide describes the entire *Life Lab* program as well as the instructional and learning strategies that support the program. Spanish language versions of the student lab books are also available. (Author/KSR)

Author: Developed by the Life Lab Science Program

Series: Life Lab Science

Reference no.: ENC 001467

Funding: National Science Foundation

Evaluation:

Citations:

Knorr, Kim. "Discover Life Lab Science: A Growing Adventure." *American Horticulturist*. July 1994, Vol. 73, No. 7, p. 16-17.

"Life Lab Science." *Teaching PreK-8*. February 1993, Vol. 23, p. 16.

Oehring, Sandra. "It's Not Just Science—It's Life!" *Instructor*. March 1993, Vol. 102, No. 7, p. 65-66.

Related resources:

This series contains curricula for grades K-5, each with a different year long theme.

Earth is Home

The theme unifying this grade 1 curriculum is diversity and cycles. Students examine the amazing diversity that is found in both living and nonliving things including seeds, soil, weather conditions, plants, and animals. As students investigate nature's diversity, they also learn that many things change in predictable ways.

DASH: Grade K

Grade K

DASH Project
Curriculum Research and
Development Groups
1776 University Avenue
Honolulu, HI 96822
Telephone no.: (808) 956-7863
1 set of p: int materials: $300.00

Subjects: *Animals; Botany; Calendars; Communication skills; Energy; Environment; Families; Food; Health; Map skills; Matter; Moon; Nutrition; Plants (Botany); Recycling; Safety; Science; Seasons; Senses; Technology; Time; Transportation; Weather.*

1990

Abstract: *Developmental Approaches in Science and Health (DASH)* is a sequential K to 6 program that integrates the contents of science, health, and technology. In *DASH*, children discover the workings of science through practical, hands-on experiences designed to promote children's mental and physical development. The curriculum is constructivist-based; uses concept maps extensively; involves students in self evaluation; advocates that teachers use portfolio-based judgment of student progress; builds on cooperative learning; and has a strong environmental component. The curricula for all grades have the same ten strands including learning in general; time, weather, and the sky; animals; plants; food and nutrition; health and safety; wayfinding and transportation; energy and communication; conservation, recycling, and decomposition; and matter, space, and construction. The teacher's guide provides from four to twenty-one activities per strand, each building on the activities from the previous year and appropriate for each specific grade level. Each activity includes the objectives, background information, the role students should play, a materials list, student products, the procedures, and possible extensions. A second manual includes the student handouts for the activities, a grade K suggested yearlong activity schedule, a scope and sequence of activities for the entire *DASH* program, and a comprehensive materials list for the kindergarten program. An instructional guide is available for the entire program. (Author/KSR)

Author: Principal authors: Francis M. Pottenger III, Carol Ann Brennan, Karen N. Yamamoto

Series: DASH (Developmental Approaches in Science and Health)

Publisher: Honolulu, HI : University of Hawaii

Reference no.: ENC-001229

Funding: Hawaii Department of Business and Economic Development; National Science Foundation (NSF); University of Hawaii, Curriculum Research and Development Group

Evaluation: Citations:

Angotti, Rose. "Teachers Become Pupils." *Pittsburgh Post-Gazette*. July 21, 1994, p. E4.
Angotti, Rose. "Teachers DASH into New Approach." *Pittsburgh Post-Gazette*. July 28, 1994, p. W2.
Kinnaman, Daniel E. "Newsline: Dashing to a New Science Curriculum." *Classroom Computer Learning*. November 1988, Vol. 9, No. 3, p. 10.

Related resources: Another series from the ENC Resource Finder promotes active learning in the elementary grades.

Elementary Science: Grade 4
Curriculum writing team, Jake Barkette, Carol Burkhouse, Cindy Cummings, Barbara Gilbert, Ray Gilbert, Jean Hetherington, G. Hibberd, Sharon Papas, Marilee Sackett, Keith Taylor, Judy Thompson.
Hands-on Elementary Science Dissemination, Hampstead, MD. Telephone no.: (410) 374-1350
The elementary science curriculum guide series, part of · · National Diffusion Network, was designed for grades 1 to 5 by teachers in Carroll County, Maryland, public schools. The series' primary goal is to help students understand science from a hands-on approach. This book covers life science and physical science. Three units and an optional unit are included.Units cover such topics as living creatures and their habitats, static electricity, and forms of matter.

Exploring Science: Volume 3

Grade 3

Macro Press, Inc.
18242 Peters Court
Fountain Valley, CA 92708
Telephone no.: (714) 964-9191
1 student text: $8.50
1 teacher's resource book: $120.00

Subjects: *Biological sciences; Earth science; Ecosystems; Energy; Entomology; Environment; Food chain; Food webs; History of science; Insects; Moon; Physical sciences; Physics, Planets; Process skills; Recycling; Science; Scientists; Social studies; Solar system; Space sciences; Stability; Systems; Women in science.*
1993

Abstract: This integrated science program, developed for grades K to 6, focuses on the student as scientist as he or she develops science process skills and uses scientific thinking processes in a variety of multi-sensory, hands-on experiences. Each grade level program uses a thematic approach to introduce students to topics and investigations in earth, life, and physical science. Other subject areas integrated into the program include language arts, reading, mathematics, visual and performing arts, history and social science, and current issues and technology. This grade 3 program introduces the themes of energy, systems and interactions, stability, and science and social studies by using biographical sketches of Margaret Collins, Miguel Rios, Ruth Patrick, Stephen Hawking, and Sally Ride. Each activity in the teacher's guide includes thematic emphasis, science concepts, scientific thinking process skills, key questions, vocabulary list, materials list, discussion questions, further explorations, evaluation questions, variations and challenging extensions, and a home school activity. Each student records data in his or her own *Scientist's Notebook*. A student book includes the biographical sketches of each scientist, songs, and other scientific information. A description of the program includes professional development materials for the teacher such as information on cooperative learning, authentic assessment, students with disabilities, and English as a second language students. A catalog describing the program and examples of student activities from each of the grade levels as well as a video of program highlights is also available. (KSR)

Author: Harriette (Jerry) Bolliger, Linnea Nell Haley, Mony S. Park, Kathleen Davis Manual, Neva Yribarren, Ann Goodman Parrish, Leigh Hoven-Severson, Penelope Walters Swenson, Carrie Luger Slayback

Series: Exploring Science

Reference no.: ENC 001405

Standards: Project 2061

Related resources: Other resources combine literature or reading with the study of science for K-12 classes.

Who's Endangered on Noah's Ark? Literary and Scientific Activities for Teachers and Parents
Glenn McGlathery and Norma J. Livo
Teacher Ideas Press, Englewood, CO, Toll-free no.: (800) 237-6124
This book, developed for students of all ages, concerns ten of the animals that are or have been threatened: wolves, bears, elephants, tigers, leopards, California condors, northern spotted owls, bald eagles, whooping cranes, and alligators. Each section includes a folktale and folklore about the animal and discussion of its description, behavior, habitat, historic range, current distribution, and status as an endangered species. The folktales introducing each chapter are drawn from many different cultures and traditions. This section is followed by activities investigating the animal's environment and current status, plus activities involving art, literature, writing, and drama. A bibliography for additional information and reading is included at the end of each chapter.

Frog Math:
Predict, Ponder, Play

Grades K-3

GEMS
Lawrence Hall of Science,
University of California
Berkeley, CA 94720-5200
Telephone no.: (510) 642-7771
1 text: $12.50

Subjects: *Art; Classification; Data analysis; Data collection; Estimation; Integrated/Interdisciplinary approaches; Literature; Logical reasoning; Mathematics; Observation; Patterns (Mathematics); Prediction; Probability; Statistics.*

1992

Abstract: This series of teacher's guides contains guided discovery, hands-on activities that have been published under the *Great Explorations in Math and Science (GEMS)* title, after a refinement process that includes classroom testing of trial versions; also included are step-by-step instructions and background information to allow presentation by teachers without special background in math or science. Activities and games in this book, developed for grades K to 3, integrate literature, art, and writing with math and are intended to develop such skills as observation, prediction, classification, estimation, and recording data. Students begin by listening to a story (not included) from Arnold Lobel's *Frog and Toad are Friends* about a lost button. Students then explore attributes of buttons as they sort and classify real buttons, create paper buttons, and organize them on a grid. In other sessions, students estimate the number of plastic frogs in a jar, and play games designed to develop logical thinking skills and introduce probability and statistics. Extension and age modification suggestions are included. Also included are source lists for suggested materials, bibliographic information for suggested books, and blackline masters. A handbook series offers ways that the *GEMS* teacher's guides can be used from various perspectives and includes the teacher's handbook, leader's handbook, parent's guide, *To Build a House* (a thematic approach to science teaching), *Once Upon a GEMS Guide* (literary annotations), and a forthcoming *Outcomes* (assessment) handbook. Spanish translations of the blackline masters are available for the series. (Author/MPN)

Author: Jaine Kopp

Series: GEMS

Reference no.: ENC-001933

Funding: Hewlett Packard Company Foundation

Evaluation: Citation: Capra, Lisa [West Palm Beach, FL]. "Reviewing and Viewing: For Teachers." *Teaching Children Mathematics*. September 1994, Vol.1, No. 1, p. 46.
"Helping Children Solve Problems and Make Discoveries: Frog Math by Jaine Kopp" *Science Teacher*. October 1992, Vol. 59, No. 7, p. 16.

Field tested or reviewed by the following schools: — Manzanita Elementary School, Phoenix, AZ; College View Elementary School, Huntington Beach, CA; Agnes L. Smith School, Huntington Beach, CA; Loama and Marshall Elementary Schools, Anaheim, CA; Palm Lane and Jefferson Elementary Schools, Anaheim, CA; Columbus Intermediate School, Berkeley, CA; Glassbrooke Elementary School, Hayward, CA; Henderson Elementary School, Bernicia, CA; Hoover Elementary School, Oakland, CA; Oxford Elementary School, Berkeley, CA; Park Day School, Oakland, CA; Steffan Manor School, Vallejo, CA; Stoneman Elementary School, Pittsburg, CA; Travis Elementary School, Vallejo, CA; Windrush School, El Cerrito, CA; Seaborn Lee Elementary School, Atlanta, GA; Dunn Elementary School, Louisville, KY; Coleridge-Taylor Elementary School, Louisville, KY; D'Youville Porter Campus School, Buffalo, NY; Science Magnet School #59, Buffalo, NY; Cedaroak Park Elementary School, West Linn, OR; Deepwood Elementary School, Round Rock, TX; Arlington Elementary School, Spokane, WA; Bemiss Elementary School, Spokane, WA.

GrowLab:

Activities for Growing Minds

Grades K-8

GrowLab
180 Flynn Avenue
Burlington, VT 05401
Toll-free no.: (800) 538-7476
1 activity book: $24.95
Video about program: Free
2 resource videos: $29.95 each

Subjects: *Acid rain; Adaptations; Biological diversity; Biological sciences; Botany; Classification; Environment; Gardens; Leaves (Botany); Life cycle; Photosynthesis; Plant growth; Plant reproduction; Plants (Botany); Pollution; Process skills; Roots (Botany); Science; Seeds; Soils; Stems (Botany); Vegetative propagation; Wisconsin fast plants.*

1990

Abstract: This program, developed for grades K to 8, provides a context in which students can use their own questions and ideas to inspire hands-on investigations of the natural world, explore key plant science and environmental concepts, and gain confidence in their ability to do science. Activity topics include seeds, needs of plants, roots, plants as food producers, soil, plant cycles, plant growth, the diversity of plants, adaptations, the interdependence of plants and animals, the impact of humans on plants, and pollution. Features of the program include a developmentally appropriate activity curriculum guide; a teacher's guide with important horticultural information and gardening tips; a national newsletter facilitating idea exchange among teachers; materials and technical assistance to facilitate partnerships; teacher resource videos; a national database network containing a range of information on educators engaged in plant-based instruction and on partners who provide resources and support to teachers; and emerging teacher enhancement materials and models to help teachers cultivate an inquiry teaching approach. The three teacher resource videos describe the program, provide important horticultural information and gardening tips, and explain the teaching strategy used in this program. The teaching strategy includes four parts: laying the groundwork, exploration, making connections, and branching out. Each activity's format reflects this multistep teaching strategy. Each activity also includes the suggested grade range, an overview, time needed, materials list, background information, and advance preparation. The activity guide provides teaching tips on questioning, grouping students, assessing student learning, and fostering healthy science attitudes; a discussion of conceptual and topical themes; and a listing of all activities and the process skills that are emphasized in each. Appendices include information on Wisconsin Fast Plants, resources for students and teachers, and seed sources. (Author/KSR)

Author: National Gardening Association

Publisher: Burlington, VT: National Gardening Association

Reference no.: ENC-001518

Funding: National Science Foundation

Evaluation: Citations:

Hershey, David R. "Making Plant Biology Curricula Relevant." *Bioscience*. March 1992, Vol. 42, No. 3, p. 188-191.

Parsons, Tim. "GrowLab: Helping Young Minds Grow." *American Horticulturist*. July 1994, Vol. 73, No. 7, p. 15-16.

Related resources: A newsletter is available to accompany this resource or to stand alone, and contains hands-on activities related to gardens.

Growing Ideas: A Journal of Gardening Based Learning
National Gardening Association, Burlington, VT. Toll-free no.: (800) 538-7476
This journal, developed for elementary and middle school teachers, contains many activities and stories. A range of topics is covered in each volume, such as the teacher exchange in which lesson or unit ideas are presented, free or low cost resources for classroom activities, and a teaching methods section.

How to Use Children's Literature to Teach Mathematics

Grades K-6

National Council of Teachers
of Mathematics, Inc.
1906 Association Drive
Reston, VA 22091-1593
Toll-free no.: (800) 235-7566
1 text: $8.50

Subjects: *Arithmetic; Classification; Graphing; Integrated/Interdisciplinary approaches; Literature; Mathematics; Mathematics curriculum; Mathematics instruction.*

1992

Abstract: This illustrated book explains how to use childrens' tales like *Stone Soup* (not included) to help students in grades K to 6 grasp math concepts such as graphing and measuring. The book contains brief summaries of several stories and suggestions for hands-on activities that connect each story with mathematics. Four general NCTM standards (mathematics as problem solving, mathematics as reasoning, mathematics as communication, and mathematical connections) underlie the interdisciplinary approach to mathematics teaching in this book. Several uses of literature in mathematics instruction are described: to provide a context or model for an activity; to introduce manipulatives; to inspire a creative math experience; to pose an interesting problem; and to prepare, develop, or review a mathematics concept or skill. The book is written in nontechnical language and is designed to be directly applicable to the teaching of mathematics and have immediate classroom use. (Author/DDD)

Author: Rosamond Welchman-Tischler

Reference no.: ENC-001524

Standards: NCTM standards (1989). — Content standards: Grades, K-4. — Mathematics as problem solving; Mathematics as communication; Mathematics as reasoning; Mathematical connection. NCTM standards (1989). — Content standards: Grades, 5-8. — Mathematics as problem solving; Mathematics as communication; Mathematics as reasoning; Mathematical connection

Evaluation: Citations:

Hargreaves, Meryl. "How to Use Children's Literature to Teach Mathematics [book review]." *Mathematics Teaching*. March 1994, Vol. 146, p. 38-39.

O'Shea, Thomas. "How to Use Children's Literature to Teach Mathematics [book review]." *Teaching Children Mathematics*. March 1995, Vol. 1, p. 460.

Smith, Kay E. "Telegraphic Reviews: How to Use Children's Literature to Teach Mathematics by Rosamond Welchman-Tischler." *American Mathematical Monthly*. May 1994, Vol. 101, No. 5, p. 486.

Related resources: Many educational resources integrate mathematics with other content areas, from literature to science to social studies.

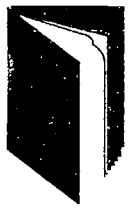
Patterns
Terrence G. Coburn with Barbara J. Bushey, Liana C. Holton, Debra Latozas, Debbie Mortimer, Deborah Shotwell
National Council of Teachers of Mathematics (NCTM)
Designed for instructors of grades K to 6, this booklet is a compilation of lessons and activities that allows students to consider patterns that involve objects, number relationships, and geometric designs. Activities allow students to recognize, extend, create, and analyze patterns. Each chapter contains pattern activities appropriate to one grade level. Connections are made throughout to science, language arts, social studies, and other areas in the curriculum. This booklet is part of the NCTM *Addenda Series*, intended to clarify and facilitate the implementation of the NCTM Standards.

Inventor's Lab

Grades 4-6

Reading is Fundamental, Inc.
600 Maryland Ave., SW
Washington, DC 20024
Telephone no.: (202) 287-3220
1 text: Free

Subjects: *African-Americans in science; Circuits; Communications; Creative writing; Electricity; Inventions; Inventors; Language arts; Process skills; Reading; Science; Scientific method; Technology.*



1992

Abstract: This science and reading motivation program is designed to supplement existing science curricula for the upper elementary grades and to integrate science and technology with reading through a series of activity labs. This unit of the *Science Technology and Reading (STAR)* program involves students in exploring electricity by conducting lab work similar to that of African-American inventor Lewis Latimer's work on electrical circuitry, and processes of invention by involving students in a sample invention process. Program goals are to help children feel more comfortable and confident about science, to familiarize children with different fields of science and inspire them to consider science career paths, and to further children's learning in science and reading by engaging them in activities that foster both. The program is currently composed of four labs or units of hands-on science activities that can be run independently by small groups of children working together. Materials provided for each lab include 1) a core group of hands-on science activities; 2) links between a different genre of children's literature and each lab; 3) interdisciplinary activities that extend learning in the science lab to other areas of the curriculum including language arts, math, social studies, and art; and 4) a list of books, computer software, audiovisual materials, and other resources to support lab work and reading. Each activity within the lab is accompanied by a teacher's guide, containing an overview, learning objectives, list of supplies, tips for planning and managing the lab, suggestions for follow-up discussion, extensions, and reproducible handouts. (LZ/KSR)

Author: Reading is Fundamental; curriculum writers, Pat Drizd, Collette Corbin, Martrice Green, Marti Powell, Marilyn Phykan, Pam Spenser, Paula Tiberii

Series: Science Technology and Reading (STAR)

Reference no.: ENC-001924

Funding: Chrysler Corporation Fund; General Electric Foundation

Evaluation: Field tested in the following schools: — Liberty Elementary School, Highland Park, MI; Bethune Elementary School, Pontiac, MI; Howe Elementary School, Detroit, MI; Lubeck Elementary School, Parkersburg, WV; Greenmont Elementary School, Parkersburg, WV; Rayon Elementary School, Parkersburg, WV; Jefferson Elementary School, Parkersburg, WV.

Related resources: Other units in this program focus on different topics for hands-on investigations.

Habitat Lab
This unit of the *STAR* program involves students in exploring the interdependence among animal and plant life by observing habitats of their own making. Directions for building earthworm, cricket, and mealworm habitats are provided.

Mystery Lab
This unit of the *STAR* program involves students in exploring scientific processes and problem solving by conducting a series of investigations based on a detective story. Activity topics include fingerprinting and plant chromatography.

Investigating Patterns of Change

Grades 5-8

Kendall/Hunt Publishing Company
2460 Kerper Boulevard, P.O. Box 539
Dubuque, IA 52004-0539
Toll-free no.: (800) 258-5622
Text: $33.90
Teacher's edition: $64.90

Subjects: *Change (Theme); Continental drift; Earth science; Earthquakes; Ecology; Environment; Geology; Hurricanes; Plate tectonics; Pollution; Probability; Recycling; Science; STS; Technology; Thematic approach; Tornadoes; Waste management; Water cycle; Weather.*

1994

Abstract: This student textbook, teacher's edition, and teacher's guide and resource book make up Level A in a three year (Levels A, B, and C) science and technology program designed for middle school students. Some key points of the program include an emphasis on process skills, especially higher order thinking skills; a focus on social issues and the connections among science, technology, and society; an integration of the science disciplines with one another and with other disciplines; and an organization of the curriculum around unifying themes rather than topics. The student textbook includes 15 chapters within four units that investigate patterns of change; explanations for the patterns of change on Earth; natural events and natural disasters; and patterns and people. Each chapter includes several investigations that focus on a subtopic relating to the unit. Investigations contain full color photographs and illustrations. The instructional model used in investigations is characterized by the five E's: engage, explore, explain, elaborate, and evaluate. The teacher's edition includes an in-depth program overview for each of the three levels. Within the overview is a series of charts that provides the teacher a quick overview of the scope, sequence, and learning outcomes for all three levels of the curriculum. Another chart relates each of the five E's to specific teacher and student actions that are either consistent or inconsistent with the goal for that particular step. The teacher's edition also contains the following information for each investigation: an introductory statement, outcomes and indicators, advance preparation, instructional strategies, working environment, materials, procedures, and discussion questions. (TDB)

Author: BSCS Innovative Science Education

Series: Middle School Science & Technology

Reference no.: ENC-000145

Funding: National Science Foundation; IBM Educational Systems (Atlanta, GA); Science Kit & Boreal Laboratories, Inc. (Tonawanda, NY)

Related resources: This series continues its thematic approach over three levels.

Investigating Diversity and Limits
The student textbook for Level B in this series includes 15 chapters within four units that investigate the following: human diversity, the relationship between diversity and technology, scientific explanations for the diversity of matter, and using the theory of inheritance to explain the diversity of characteristics. Students explore the limits they experience in accomplishing certain tasks and recognize that all humans have different limits; learn some basic concepts about technological designs as well as the technological design process that helps people overcome limits and solve problems; explore the uniqueness of certain materials, offer scientific explanations on how to test the materials, and understand why things are different; and use the scientific modeling techniques to begin developing their own explanation for the reason behind diversity.

Kindergarten Book

Grade K

National Council of Teachers
of Mathematics, Inc.
1906 Association Drive
Reston, Virginia 22091-1593
Toll-free no.: (800) 235-7566
1 text: $9.50

Subjects: *Arithmetic; Assessment; Classification; Data analysis; Geometry; Graphing; Mathematics; Number concepts; Numbers; Patterns (Mathematics); Shapes; Spatial ability; Statistics.*

1991

Abstract: The National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* is a blueprint for reform that identifies a set of standards for the mathematics curriculum in grades K to 12, standards for evaluating students' performances, and standards for evaluating the quality of programs. Written by classroom teachers, mathematics supervisors, and university mathematics educators, this is the kindergarten book of the NCTM *Addenda Series, Grades K to 6*. The series is designed to illustrate the Standards and to help teachers translate them into classroom practice through sample lessons and discussions that focus on the development of concepts, activities that connect models and manipulatives with concepts and with mathematical representations, problems that exemplify the use and integration of technology, teaching strategies that promote students' reasoning, approaches to evaluate students' progress, and techniques to improve instruction. The themes of problem solving, reasoning, communication, and mathematical connections are woven throughout the materials, as is the view of assessment as a means of guiding instruction. In this booklet, traditional and new topics are explored in four areas: patterns, number sense and operations, making sense of data, and geometry and spatial sense. Traditional kindergarten activities are given an investigative flavor. These activities include finding patterns in the calendar, sorting objects according to attributes, and copying figures. There is also a variety of problems and questions to explore with students. Margin notes give teachers additional information on activities and on additional topics such as student self confidence, evaluation, and grouping. Supporting statements from the Standards appear in the margin notes. Connections to other curricular areas are made throughout the booklet. Booklets in the series may be used in inservice programs and for preservice courses in teacher education programs. Activities have been field tested by teachers to ensure they reflect the realities of classrooms. (Author/AM)

Author: Grace Burton, Terrence Coburn, John Del Grande, Mary M. Lindquist, Lorna Morrow with Douglas Clements, John Firkins, Jeane Joyner

Series: Addenda series, Grades K-6

Reference no.: ENC-000551

Standards: NCTM standards (1989) — Content standards: Grades K-4. — Mathematics as problem solving; Mathematics as communication; Mathematics as reasoning; Mathematical connection; Concepts of whole number operations; Estimation; Fractions and decimals; Geometry and spatial sense; Measurement; Number sense and numeration; Patterns and relationships; Statistics and probability; Whole number computation

Evaluation: Citations:

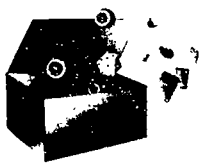
Welchman-Tischler, Rosamond. "New Books: Curriculum and Evaluation Standards for School Mathematics: Kindergarten Book." *Arithmetic Teacher*, September 1992, Vol. 40, p. 57.

Mathematics Curriculum and Teaching Program

Grades K-10

National Council of Teachers
of Mathematics, Inc.
1906 Association Drive
Reston, VA 22091-1593
Toll-free no.: (800) 235-7566
1 set (2 volumes, 3 videos, 1
computer disk, 1 monograph, 1
assessment kit): $160.00

Subjects: *Algebra; Assessment; Estimation; Geometry; Instructional improvement; Mathematics; Mathematics curriculum; Mathematics education; Mathematics instruction; Probability; Problem solving.*



1992

Abstract: This K to 10 mathematics curriculum resource is a collaborative program with computer software, videos, and printed curriculum materials that is based on classroom activities developed and used in Australia. Specific themes identified for this program include the effective use of technology, the potential benefits of cooperative group work, and ensuring that school mathematics has a greater sense of relevance and purpose. The two print volumes have classroom activities that cover a wide variety of topics including probability, estimation, geometry, problem solving, algebra, logic, number properties, and visual imagery. The mathematical concepts are taught under many headings, which include computers, mathematical modeling, social issues in the mathematics classroom, and the role of video in the mathematics classroom. A chart that delineates the recommended grade levels of the activities and major mathematical features is also provided. Included with the activities are: background information, implementation plans and assessment suggestions, extensions, worksheets, photographs, and illustrations. Software and videotapes are included for use in some of the activities. The videotapes show applications of mathematics in activities such as: some of the best women's divers and their scores from the 1984 Olympic Games; Heptathlon and Decathlon events at the 1984 Olympic Games; and the 1986 Darts Championships. The software is used to check answers, produce tables, and generate data for analysis. The resource also provides a monograph, *Guidelines for Consultants and Curriculum Leaders*, that focuses in a single volume on how to implement the program's approach and includes professional development activities, and an assessment kit that includes a booklet on assessment alternatives in math and two support volumes of linked lessons and blackline masters. (Author/VN)

Author: Charles Lovitt and Doug Clarke

Publisher: Carlton, Victoria, Australia: Curriculum Corporation

Reference no.: ENC-000843

Standards: Australia. National statement on mathematics for Australian schools.
NCTM standards (1989).

Equipment: System requirements: Apple version—Apple IIe, IIc; 80 column card. IBM version—IBM or compatible; 512K memory (minimum) [Written in Turbo Pascal version 5 and cannot be easily listed. A disk containing the source code for the programs can be obtained on request from Curriculum Corporation for $5.00]. Macintosh version—any Macintosh computer.

Evaluation: Citation:
Mason, Brian N. "Etcetera: Mathematics Curriculum and Teaching Program." *Arithmetic Teacher*. March 1993, Vol. 40, No. 7, p. 418.

Minds-on Science: For Profit, For Planet

Grades 5-9

Tom Snyder Productions, Inc.
80 Coolidge Hill Rd.
Watertown, MA 02172-2817
Telephone no.: (617) 926-6000
Toll-free no.: (800) 342-0236
Fax no.: (617) 926-6222
1 laserdisc kit: $249.95

Subjects: *Biological sciences; Biotechnology; Chemistry; Clothing; Cooperative learning; Decision making; Economics; Environment; Genetic engineering; Industry; Integrated/Interdisciplinary approaches; Language arts; Plastics; Polymers; STS; Science; Science and society; Science policy; Social studies; Technology.*

1995

Abstract: This interdisciplinary multimedia package, designed for grades 5 to 9, is part of the *Minds-On Science* series developed by the National Museum of American History, Smithsonian Institution (based on the contents and concepts of the Science in American Life exhibit, funded by the American Chemical Society). In this simulation, students assume the role of president of Future Look Fashions, a clothing manufacturer. In order to preserve its lead position in the industry, the company seeks a breakthrough, the result of which may affect the environment. Working in cooperative groups, students collect data as they take on the role of chemists, technologists, and environmentalists. In turn, students must make decisions involving conflicting scientific data and opinions. The program is designed to develop an awareness of important scientific and industry issues that affect society and the environment. The program covers topics in science, social studies, and language arts (including critical reading, writing, and debate). The resource includes student workbooks containing briefings and activities designed to help students establish goals and assist them in the decision-making process. Evaluating the consequences of their decisions and the goals they set, students learn that the decisions they make have broad and significant impact. Video segments in this laserdisc program may be accessed using a remote control or barcode reader. Topics cover polymers, techno-clothes, plastics, engineering genes, spray-on clothes, recycling, enviro-clothes, bioindigo, and more. In addition, the program provides insight into the life and work of famous scientist Barbara McClintock. Computer software is available separately and offers management tools and navigation features. This resource was acquired, cataloged, and abstracted for ENC by the EPIE Institute.

Author: Smithsonian Institution; designed by David Dockterman, Gabrielle Savage Dockterman, Maria J. Flannagan, Pip Gilmour, Cecilia Lenk; produced by Gabrielle Savage Dockterman

Series: Minds-on Science

Reference no.: ENC-005229

Equipment: System requirements: Laserdisc player. For Level III usage: Macintosh—Macintosh computer, 3.5 inch floppy drive, laserdisc player. Windows—IBM PC & Compatibles w/Windows, 3.5 inch floppy drive, laserdisc player.

Related resources: Turning minds on in the classroom is the goal of this entire interdisciplinary series.

Minds-on Science: For the Sake of the Nation
In this simulation, students assume the role of Science Advisor to the President of the United States. The program is designed to develop an awareness of important science issues that affect the nation and focuses on the interaction between science and society. Topics are based on real-world issues: big science projects (the Manhattan Project, war on cancer, and the Human Genome Project); America's reliance on the automobile; biotechnology and genetic engineering; and the space program.

Minds-on Science: the Impact of Discovery
In this simulation, students assume the role of a research scientist who has discovered a means to improve memory. Students are faced with the dilemma of how this discovery impacts society and what should be done about it. In the process, they learn about the brain and how memory works; experience the scientific process; review conflicting data and opinions; and examine the interaction between science and the real world.

Mouse and Elephant:
Measuring Growth

Grades 5-8

Addison-Wesley Publishing Company
Jacob Way
Reading, MA 01867-9984
Toll-free no.: (800) 447-2226
1 text: $15.96
1 student activity book: $2.96

Subjects: *Area; Data analysis; Data collection; Data interpretation; Geometry; Mathematics; Perimeter (Geometry); Real data; Shapes; Surface area; Volume (Mathematics).*

1986

Abstract: Designed for grades 5 to 8, this teacher source book is part of a series of five books designed to help teachers develop students' problem solving skills via activity-oriented mathematics. In this book, concepts of area, perimeter, surface area, and volume are introduced with tiles, cubes, and story language. Each book in the series requires two to three weeks of instructional time and uses an instructional model that consists of three phases. The teacher first launches a mathematical challenge by introducing new concepts, clarifying definitions, reviewing old concepts, and issuing the challenge. The unit challenge is designed to motivate students to answer two questions: given a mouse and an elephant of specified heights, how many mice does it take to balance the elephant, and how many mouse coats are needed to make a coat for the elephant? The challenge is continued throughout the unit, and students can adjust their predictions as the unit unfolds and they gain more insight. In the second phase, student explorations are conducted individually or in small groups. In the third phase, activities are summarized, and results and strategies are refined into effective problem solving techniques. In the eight activities, students examine the effects of holding one measure constant and varying the shape; determine which shapes produce the maximum and minimum values in the varying measures; and investigate the effects of growth on different measures. A detailed instructional guide is provided for each activity. The preliminary pages contain a rationale; an overview of the main ideas; goals for the students; and a list of materials and worksheets. A script is then provided to help teach each phase of the instructional model. Worksheet answers, blackline masters, review problem answers, and a unit test and answer key are included. (Author/AM)

Author: Janet Shroyer, William Fitzgerald

Series: Middle Grades Mathematics Project

Reference no.: ENC-001544

Funding: National Science Foundatio ·

Related resources: This entire series contains hands-on activities for middle school mathematics classes.

Similarity and Equivalent Fractions
Glenda Lappan, William Fitzgerald, Mary Jean Winter, Elizabeth Phillips
This book includes nine activities that develop students' understanding of similar figures and equivalent fractions through indirect measurement, scale models, and the nature of growth. This unit begins with one approach to enlargement, using a rubber band stretcher. Activities have students enlarge figures using a coordinate system; examine similarity of rectangles and develop a test that can be used to determine whether rectangles are similar; use concrete materials to examine the relationship of the growth of area to the growth of lengths; develop quick visual tests for similar rectangles and triangles; provide a means of enlarging figures that is more accurate than the rubber band stretcher; and apply the ideas they have learned.

The Mysterious Powder

Grades 4-5

Optical Data Corporation
30 Technology Drive
Warren, NJ 07059
Toll-free no.: (800) 524-2481
1 teacher's guide: $65.00
1 materials kit $332.00

Subjects: *Acids; Bases (Chemistry); Chemical compounds; Chemical reactions; Chemistry; Mixtures; Physical properties; Process skills; Science.*

1991

Abstract: *Insights* is a hands-on inquiry science curriculum consisting of a series of modules designed to provide elementary students with science experiences that will help them learn science skills and concepts and to provide teachers with the guidance and background they need to teach science in the spirit of scientific exploration and discovery. The series encourages students to develop thinking and process skills by observing; comparing; classifying; questioning; trying out ideas and making mistakes; and discussing, analyzing, and communicating their thoughts and discoveries with their classmates. In each module, students use different materials to investigate phenomena and explore a scientific theme in depth. This module (grades 4 to 5) contains 13 learning experiences that cover approximately 20 sessions (45 minutes each) in which students explore the properties of certain substances and practice the steps of the scientific process. Two major organizing themes run throughout the module: change, and cause and effect. The module begins with a questionnaire to assess students' knowledge about the properties of certain substances and about scientific problem solving. Learning experiences involve students in the following activities: defining and analyzing a simulated event and making initial predictions; describing six unknown white powders using only their senses of sight, touch, and smell; exploring the six powders by mixing them with four liquids in a systematic way and carefully recording their data; differentiating one powder from the rest by using iodine; using phenolphthalein and phenol red to determine which of the powders and liquids are bases or acids; analyzing a new substance by applying all the techniques they have learned and determining what it is; and applying their skills and knowledge of scientific procedure to the preparation of household products. The module concludes with a performance assessment and a questionnaire. Each learning experience includes all or some combination of the following four phases: getting started; exploring and discovering; processing for meaning; and extending ideas. This module includes reproducible masters for science notebook pages, teaching suggestions, a teaching learning framework, a science thinking and process skills framework, an assessment framework, organization of each learning experience, a summary of the materials needed, and teacher resources including books and audiovisual materials. (TDB)

Author: Education Development Center, Inc.

Series: Insights Elementary Science Curriculum

Publisher: Newton, MA: Education Development Center, Inc.

Reference no.: ENC-000875

Funding: National Science Foundation

Related resources: This series contains many modules with different hands-on activities for students in elementary grades.

Balls and Ramps
This module (grades K to 1) contains 14 learning experiences that cover approximately 20 sessions (45 minutes each) in which students explore balls and their motion. Two connecting themes run throughout the module: the properties and characteristics of balls and the things that affect the way balls behave. The module begins with an individual or group interview in which students share their ideas about the characteristics of balls. Learning experiences involve students in several activities, including: focusing on some of the differences (size, weight, bounciness) among balls as they explore and record their findings; and using a variety of balls to begin to relate movement to the physical characteristics of balls.

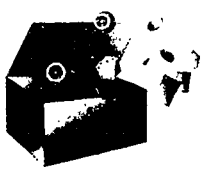
Overhead Math:

Manipulative Lessons on the Overhead Projector

Grades 3-6

Creative Publications
5040 W. 111th Street
Oak Lawn, IL 60453-9941
Toll-free no.: (800) 624-0822
1 kit: $90.00
1 resource book: $26.00

Subjects: *Arithmetic; Counting; Decimal fractions; Fractions; Geometry; Logical reasoning; Mathematics; Measurement; Money; Number concepts; Pattern recognition; Patterns (Mathematics); Place value; Spatial ability.*



1990

Abstract: Designed for grades 3 to 6, this kit includes eight sets of transparent manipulatives for the overhead projector and a resource book with 40 lessons that use the manipulatives. The manipulatives include coins and bills, Decimal Factory blocks, Fraction Factory pieces, Fraction Circles PLUS, geoboards, pattern blocks, tangrams, and attribute blocks. Topics include counting, number concepts, place value, number patterns and relationships, whole number operations, money, decimals, fractions, geometry, measurement, logic and reasoning, and spatial reasoning. The resource book summarizes math concepts and understandings that students can explore and develop with the manipulatives; gives information about the materials needed for the lessons; and provides sources of related activities. There is an introductory activity and five lessons for each manipulative, arranged according to level of difficulty. Lessons were developed to support the goals and standards given in the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards for School Mathematics* and in state mathematics frameworks such as California and Texas. Each lesson includes three kinds of activities: a teacher-directed exploration with the whole class or small groups using the overhead set of manipulatives; problems for small groups that use the manipulative and extend the initial exploration; and questions and ideas that encourage students to describe their solutions, thinking, and explorations. (Author/AM)

Author: Shirley Hoogeboom, Judy Goodnow

Reference no.: ENC-001360

Standards:
California State Mathematics Framework
Texas State Mathematics Framework
NCTM standards (1989). — Content standards: Grades K-4. — Concepts of whole number operations; Fractions and decimals; Patterns and relationships; Geometry and spatial sense; Measurement. NCTM standards (1989). — Content standards: Grades 5-8. — Geometry; Measurement; Number sense and number relationships; Patterns and functions

Evaluation: Citations:
Foley, Patricia Dell. "Etcetera: Overhead Math." *Arithmetic Teacher.* April 1994, Vol. 41, No. 8, p. 507.
Morganti, Mary. "Etcetera: Overhead Math." *Arithmetic Teacher.* April 1992, Vol. 39, No. 8, p. 60.

Related resources: Many resources are available for teaching mathematics with the overhead projector.

Transparent Circle Geoboard for the Overhead Projector
Creative Publications, Oak Lawn, IL, Toll-free no.: (800) 624-0822
Designed for grades K to 9, this transparent circle geoboard for the overhead projector can be used for circle and trigonometry explorations. It has pins every 15 degrees, a center pin, and pins outside the circle for tangent study.

Hundred Number Boards for the Overhead Projector: Deluxe Set
Creative Publications
Designed for grades 1 to 9, this kit includes two sets of manipulatives that can be used for demonstrating counting, number patterns, operations, etc. on the overhead projector. Each set includes three overhead hundred number boards (0 to 99, 1 to 100, and a blank grid), 100 transparent one-centimeter colored tiles, 20 opaque tiles, and one set of clear plastic tiles imprinted with the numerals 0 to 100.

Particles and Prairies:
the Fermilab Prairie Savannah

Grades 5-8

Lederman Science Center
Fermilab
P.O. Box 500, M.S.777
Batavia, IL 60510
Telephone no.: (708) 840-8258
1 kit: $230.00

Subjects: *Amphibians; Animals; Aquatic ecology; Biological diversity; Biological sciences; Biomes; Birds; Botany; Classification; Data analysis; Data collection; Ecology; Environment; Fire; Food chain; Forests; Grasses; Grasslands; Insects; Invertebrates; Mammals; Mathematics; Plants (Botany); Pollination; Prairies; Process skills; Quadrat studies; Reptiles; Science; Seed dispersal; Seeds; Succession; Water; Weather; Weeds.*

1992

Abstract: This kit contains all the activities and equipment needed to prepare middle school students for a successful field trip to Fermilab's restored prairie. The goal of this program is to provide students with the opportunity to be scientists first in their classrooms and on school grounds and then on the field trip. The hands-on focus of this unit is designed to enlighten a future generation to this fragile, beautiful world. The kit's audiovisual resources include a five-minute introductory video introducing students to the prairie and to their roles as researchers, preview slides providing students with the visual background to enable them to identify the more common prairie organisms, and a video component with a laserdisc and Macintosh software. The laserdisc contains approximately 600 slides of animals and plants of the prairie; eleven bird calls; and short video segments of the reconstruction project, early history of the site of the Fermilab prairie, the Fermilab prairie as an outdoor lab, and abiotic and biotic components of the prairie. The software allows students to explore the video materials, play games related to the various topics, view time lapse photography showing changes in the prairie after a burn, and identify plants they have seen on the prairie. The activities in the teacher's guide include the purpose, objectives, background information, materials list, procedure, discussion questions, homework assignments, extension activities, data sheets, and when appropriate, the bar codes and frame numbers from the laserdisc. The activities are categorized according to the most emphasized process skills as well as their interdisciplinary connections. The glossary includes bar codes and frame numbers for many of the entries to reference the laserdisc. Data sheets are supplied for many animals and plants and include the classification from kingdom to species, a description of their primary habitat, characteristics, and where appropriate, behavior and reproduction information. (KSR)

Author: Friends of Fermilab and Fermi National Accelerator Laboratory

Publisher: Batavia, IL: Friends of Fermilab, Fermi National Accelerator Laboratory

Reference no.: ENC-001539

Funding: Friends of Fermilab; Illinois State Board of Education — Science Literacy Program; United States Department of Energy — Office of Energy Research

Equipment: System requirements: Laserdisc player with a remote control unit and/or barcode reader, video monitor, video/audio cables between player and monitor; Macintosh computer with Hypercard installed and serial cable between the computer and laserdisc player are optional.

Evaluation: Award: NewMedia Invision 1993, Multimedia Award of Excellence and Gold Award for K-12 Education

Related resources: Outdoor activities are an effective way to teach children about different facets of environmental and earth sciences.

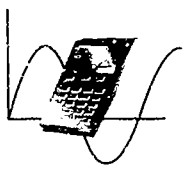
Sharing Nature with Children: the Classic Parents' and Teachers' Nature Awareness Guidebook
Joseph Cornell
Dawn Publications, Nevada City, CA, Telephone no.: (916) 292-3482
This book of activities, developed for ages 3 and up, uses nature to stimulate joyful, enlightening insights and experiences for children. Each of the 42 activities indicates the basic mood, the concepts, attitudes, and qualities it teaches such as empathy and patience; when and where to play such as day or night, in a thicket or forest, number of players needed; best age range; and special materials, if any.

Quantitative Literacy:
A Non-trivial Art

Grades 5-12

Wholesale Electronic Supply,
Education Division
2809 Ross Avenue
Dallas, TX 75201
Toll-free no.: (800) 880-9400
1 videotape plus booklet: $8.95

Subjects: *Data analysis; Data collection; Data interpretation; Mathematics; Statistics.*



1994

Abstract: This video with accompanying booklet is part of a series that presents a joint project of the Mathematical Association of America (MAA) and the National Council of Teachers of Mathematics (NCTM) and is designed for middle and high school mathematics teachers. The video consists of six segments in which various facets of quantitative literacy are explored and discussed using the statistical features of the Texas Instruments TI-82 graphics calculator.. These segments were filmed either in a week long workshop for teachers or in the classrooms of the teachers who attended that workshop. In the first segment teachers consider the relationship between the deaths of manatees and the number of motorboats registered in Florida. The second segment shows how students analyze data about the 200 meter run at the Olympic Games. Both teachers and students gather data about balloons in the third segment. In the fourth segment of the program teachers study the number of boxes of cereal that would have to be purchased in order to collect all of the 10 postcards enclosed in the cereal boxes. The fifth program segment is one in which students analyze data about money that is found in their school. In the last segment, the workshop leader tells a story about the Challenger and data that were gathered about the O-rings on that rocket. The booklet gives a narrative description of the six segments in the video, discusses each segment in detail, and comments on the way quantitative literacy is used in each segment of the video. Some calculator keystrokes and a calculator program are included. A bibliography with additional information on data collection, analysis, and interpretation is provided at the end of the booklet. (Author/VN)

Author: John Harvey with the assistance of Gail Burrill and John Kenelly; producer, Tom Moore; writer/director, Charlie Walton

Series: Teaching Mathematics with Calculators: A National Workshop

Publisher: Washington, DC: Mathematical Association of America

Reference no.: ENC-001862

Funding: National Science Foundation (NSF); Texas Instruments, Inc.

Related resources: Many resources that emphasize the use of calculators are available; below is one more.

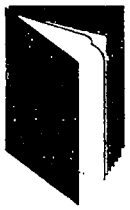
The MathMate Activity Book Levels 1, 2, 3
David E. Williams
Stokes Publishing Company, Mountain View, CA, Telephone no.: (408) 541-9145
This activity book is designed to be used with the Texas Instruments *MathMate* calculator, a basic calculator that processes multiplications and divisions before additions and subtractions. Activities provide the teacher with instructional aids in teaching problem-solving, estimation, number sense, and mental math. The book contains suggestions for using *The Educator Elementary Overhead* calculator developed by the Stokes Publishing Company. The overhead calculator matches the keyboard and display of the *MathMate* and can be used with any overhead projector.

Rocks and Minerals

Grade 3

Carolina Biological
Supply Company
2700 York Road
Burlington, NC 27215
Toll-free no.: (800) 334-5551
1 student activity book: $3.50
1 teacher's guide: $14.95

Subjects: *Classification; Earth science; Geology; Mineralogy; Minerals; Physical properties; Rocks; Science.*



1994

Abstract: This unit is one of 24 inquiry-centered hands-on science curriculum units developed for grades 1 to 6. Each unit provides children with opportunities to learn about topics in the physical, life, and earth sciences and technology through direct observation and experimentation. In this unit, developed for grade 3, students collect rocks and minerals and observe them carefully, noting similarities and differences; develop a classification system based on the physical characteristics of the rocks; and test rocks for various properties such as color, luster, hardness, streak, and weight. The teacher's guide contains 16 activities, and each provides an overview of the activity, the objectives, background information, materials needed, preparation and procedural directions, extensions, and ways to evaluate student learning. The teacher's guide also describes post unit assessments of student progress and includes an annotated bibliography of books for teachers and students. For each of the activities, a student activity book provides a "think and wonder" section, a materials list, a "find out for yourself" section which includes questions, procedures for setting up the activity, and an "ideas to explore" section. (Author/KSR)

Author: National Science Resources Center

Series: Science and Technology for Children (STC)

Publisher: Washington, DC: National Science Resources Center

Reference no.: ENC-001501

Funding: Amoco Foundation, Inc; Dow Chemical Company Foundation.; E.I. du Pont de Nemours and Company; Hewlett-Packard Company; John D. and Catherine T. MacArthur Foundation; National Science Foundation (NSF); United States Department of Defense; United States Department of Education

Evaluation: Citation:
Kelly, Dennis. "Reformers Experiment with Science Education." *USA Today*. May 15, 1991, p. 7A.

Field tested in the following schools: — Fairfax County Public Schools, VA (North Springfield Elementary School, Springfield, VA; Weyanoke Elementary School, Alexandria, VA; Great Falls Elementary School, Great Falls, VA); Bozeman Public Schools, MT (Emily Dickinson School, Longfellow School, Willson Science and Technology School, all in Bozeman, MT; Hays Lodgepole School, Hays, MT); Sheboygan Area Schools, WI (Cooper Elementary, Longfellow Elementary, Grant Elementary); San Francisco, CA (Clarendon Elementary, Spring Valley Elementary, Cabrillo Elementary); Washington, DC (Beers Elementary School). — Fall, 1994.

Related resources: This series covers different science topics for all elementary grades.

Food Chemistry
In this unit, developed for grade 4, students explore basic concepts related to food and nutrition. Using physical and chemical tests, students test several common foods for carbohydrates, fats, and proteins. Through a series of readings, students also discover how nutrients, vitamins, and minerals relate to their health.

Soap Films and Bubbles

Grades 4-9

AIMS Education Foundation
P.O. Box 8120
Fresno, CA 93747-8120
Telephone no.: (209) 255-4094
1 text: $14.95

Subjects: *Chemistry; Classification; Data collection; Geometry; Integrated/Interdisciplinary approaches; Mathematics; Measurement; Pattern recognition; Physical sciences; Science; Volume (Mathematics).*

1990

Abstract: *Activities Integrating Mathematics and Science (AIMS)* books primarily integrate mathematics and science, but also provide coordinating activities related to other curriculum areas including language arts, social studies, physical education, art, and music. This book contains a collection of hands-on activities for grades 4 to 9 in which the surface properties of fluids are explored by experimenting with soap film. Each activity has a key question. In one activity the key question is: Which surfaces are friendly to bubbles? Then background information is given, such as (in the same activity): bubbles do not pop when they land on wool, and bubbles love wet surfaces. Discussion questions are provided, and suggestions are made for students to write a story and make a bubble collage. Students can make bubbles and let them fall on different surfaces to determine whether they pop quickly, and then they record their results on a Venn diagram. Finally, in that activity, students are asked to design their own investigation to answer the key question. Also provided are the math skills and science processes involved in the activities, such as observing; measuring; working with geometric shapes; finding and using formulas; patterning; predicting; graphing; and gathering, recording, and interpreting data. Suggested materials, procedures, extensions, and illustrated student worksheets are included. (Author/MPN)

Author: Ann Wiebe; illustrations by Brenda Howsepian; editor, Dave Youngs

Series: AIMS activities: Grades 3-6; AIMS program: Grades K-4 series

Reference no.: ENC-000023

Evaluation: Citation: Berlin, Donna F. [National Center for Science Teaching and Learning] and Judith A. Hillen [AIMS Education Foundation]. "Making Connections in Math and Science: Identifying Student Outcomes." *School Science and Mathematics*. October 1994, Vol. 94, Number 6, p. 283-290.

Related resources: Hands-on activities form the core of the *AIMS* series. Below are two more books.

Popping with Power
Intended for grades 3 to 4, this book includes 21 hands-on activities investigating the physical world. Students are asked to assume the roles of machinists, engineers, and electricians as they solve various mysteries related to energy fields. Each activity generally includes: topic area, introductory statement, key question, math skills and science processes, materials, background information, management, advanced preparation, procedure, discussion, extensions, curriculum coordinates, and illustrated student worksheets. Math skills include: averaging, counting, estimating, geometry, graphing, measuring, multiplying, place value, subtracting, and timing. Science processes include: applying and generalizing; controlling variables; gathering, recording, and interpreting data; observing and classifying; and predicting and hypothesizing. Most of the investigations are appropriate for the classroom, but some require outdoor facilities.

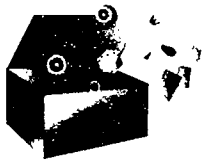
Floaters and Sinkers: Solutions for Math and Science
This activity book includes 26 activities designed for students in grades 5 to 8. Through a series of investigations, students measure volume, explore the idea of visible and invisible space between particles, discover the float line and relationship between surface area and cargo capacity of foil or clay boats, and explore the densities and volumes of wood, spherical objects, and irregularly shaped objects. The intended outcomes are math skills and science processes.

Using Energy

Grade 8

Macmillan/McGraw-Hill
School Division
220 East Danieldale Road
DeSoto, TX 75115-8815
Toll-free no.: (800) 442-9685
Unit 42 (w/out consumables): $115.68
Unit 42 (w/ consumables): $269.91

Subjects: *Conservation of energy; Energy; Gases; Heat; Heat transfer; Phase changes; Physical sciences; Science; Solids; Thematic approach; Thermal energy.*



1993

Abstract: The Macmillan/McGraw-Hill Science program includes 42 self-contained, thematic science units for grades K to 8. Each unit is presented from the perspective of one of seven themes: systems and interactions, scale and structure, stability, energy, evolution, patterns of change, or models. Themes provide a framework connecting major concepts in life, earth, and physical science. The program is organized around a sequenced series of hands-on and minds-on activities and investigations and uses a four step constructivist lesson cycle: engage, explore, develop, and extend and apply. This unit's major theme is systems and interactions. In this unit, students in middle school grades examine how our lives and lifestyles depend on energy. Students learn that temperature is a measure of the average kinetic energy of particles; that matter usually changes from solid to liquid to gas with increasing thermal energy; that heat is transferred by conduction, convection, and radiation; that energy is available from a number of natural sources; and that thermal energy is critical to life and must be developed and used responsibly. Three major science concepts are emphasized: thermal energy, which is the sum total of the energy of the particles that make up matter; heat, which is transferred from warmer to cooler objects by conduction, convection, and radiation; and energy conservation, in which students learn that energy is always conserved when it changes form. Three types of assessment are included in this unit: performance, portfolio, and tests. (CCC)

Author: Mary Atwater, Prentice Baptiste, Lucy Daniel, Jay Hackett, Richard Moyer, Carol Takemoto, Nancy Wilson

Series: Macmillan/McGraw-Hill science: K-8. Unit 42; Science turns minds on: K-8. Unit 42

Reference no.: ENC-000276

Related resources: These kits were all designed with the hands-on minds-on philosophy.

Changes in Matter
This unit's major theme is systems and interactions; the related theme is scale and structure. In this unit, students in middle school grades explore the characteristics of matter and learn that the chemical properties of matter determine how a substance reacts to form another substance. Students explore what causes matter to change from one form to another form; discuss the change of chemical properties such as baking a cake using flour, water, baking soda, and other ingredients; define the scale of atoms and describe their structure; learn 109 chemical elements and how they are identified and classified; explore what chemical reactions are; explore the world of a chemist; discover some major chemical families and how to identify them; and learn how to separate items from mixtures.

Forces at Work
This unit's major theme is systems and interactions; the related theme is patterns of change. In this unit, students in intermediate and middle school grades explore natural force (pushes and pulls on matter that produce or change motion). Five major science concepts are emphasized: motion is the change in position of an object; a force is a push or pull that one object exerts on another object; an object at rest tends to stay at rest unless acted upon by a net force and an object in motion tends to stay in motion in a straight line and at a constant speed unless acted upon by a net force; the acceleration of an object is directly proportional to the net force on it and inversely proportional to the mass of the object; and forces always exist in pairs and for every action force, there is an equal but opposite reaction force.

Using Live Insects in Elementary Classrooms for Early Lessons in Life

Grades K-3

Center for Insect Science,
Education Outreach
University of Arizona,
Forbes 410
Tucson, AZ 85721
Telephone no.: (602) 621-8555
1 text: $10.00 - 15.00

Subjects: *Anatomy; Entomology; Environment; Health; Human body; Insects; Language arts; Mathematics; Physiology; Process skills; Science.*

1993

Abstract: This set of lesson plans, developed for grades K to 3, addresses health, science, and mathematics essential skills using children's literature, science and mathematics processes, language arts, and hands-on interactions with insects. Topics include parts of the body, consumer health, decision making, disease prevention, environmental health, exercise, family life, growth and development, human diversity, human sexuality, hygiene, life management skills, mental health, nutrition, self esteem, and self protection. The lesson plans include the grade, health topic, subjects covered in the activity, best time of year to do the activity, teacher preparation list, materials list, overall objectives, an introductory activity, five to six activities, a closure activity, extensions (e.g., drama, art, and music), song sheets, and a bibliography of appropriate children's literature. Activity sheets which help guide student discovery and information sheets on the natural history of insects and how to care for them in the classroom are also included. (KSR)

Author: Center for Insect Science, Education Outreach, University of Arizona

Reference no.: ENC-001268

Funding: National Institute for Health Science Education Partnership Award

Standards:
NCTM standards (1989)
Arizona State Health Essential Skills
Arizona State Science Essential Skills
Arizona State Language Arts and Literature Essential Skills
Missouri State Health Essential Skills
Mississippi State Health Essential Skills
Massachusetts State Health Essential Skills

Related resources: Several resources involve children with the creatures and world around them.

Six-legged Science: Insects in the Classroom
Gary A. Dunn
Young Entomologists' Society, Inc., Lansing, MI, Telephone no.: (517) 887-0499
This teacher's manual investigates the world of insects and their roles in global ecology. The manual is designed to help the science instructor enhance competency in insect study; develop his or her teaching techniques and skills; know what resources are available; know how to guide young people in project selection, design, development and implementation; and learn how to involve adults as potential assistants.

Invertebrate Zoology
Ellen Doris; original photography by Len Rubenstein; produced in association with The Children's School of Science, Woods Hole, Massachusetts
Thames & Hudson Inc., dist. by W.W. Norton, Inc., New York, NY, Toll-free no.: (800) 233-4830
This series, developed for students in grades 4 to 9, provides hands-on classroom and outdoor projects that can be done by students independently or in small groups. Each book is organized by colorful two-page spreads of three kinds: projects, field trips, and theory (discussion of content) which are illustrated with many color photos of students observing, collecting, and experimenting. Topics in this book include invertebrates underfoot, squid anatomy, investigations with sponges, microinvertebrates, earthworms, and fiddler crabs.

Active Learning on the Internet

The concept of hands-on learning and the Internet may seem contradictory; however, many Internet sites facilitate active learning by students. Look for these sites and others at ENC Online; they contain lessons and activities for teachers to use in their classrooms, as well as online activities that provide the tools for experimentation.

Air Quality Lesson Plans and Data
http://198.214.57.13/WWW/TNRCC/Lesson_Plans/Air_Quality/index.html
These lessons plans are designed to provide educators who teach grades K-12 with the background, activities, and resources to teach the subject of air quality in the classroom. These projects include student experiments, background information, and links to real data in graphs and tables useful in examining a variety of air quality topics, including acid rain, the ozone layer, and carbon monoxide. These lessons were written by Texas teachers to meet the Texas Education Agency's required essential elements.

AskERIC Lesson Plans
gopher://ericir.syr.edu:70/11/Lesson/Math/
Lesson plans from the AskERIC Virtual Library cover all content areas for K-12 classrooms and are searchable. Several lesson plans for math reinforce active learning with hands-on resources. For example, one activity uses student-made peanut butter and jelly sandwiches to teach the concept of ratio. Another lesson uses Valentine's Day candy for several objectives, such as prediction, classification, sorting, graphing, and gathering and interpreting data.

Big Sky Telegraph
gopher://bvsd.k12.co.us:70/11/Educational_Resources/Lesson_Plans/Big%20Sky
Big Sky Telegraph Lesson Plans were originally created to reach teachers in rural areas who do not have much opportunity to interact with the K-12 community. For active learning, these lessons plans include "Water to the Max," an activity for grades 9-12 in math and science that has students use a hose, a protractor, and a meter stick to study angles and optimum distance. In "Area and Volume," students build their own models of square and cubic units of measurement.

The Exploratorium Science Snackbook
http://www.exploratorium.edu/publications/Snackbook/Snackbook.html
The online version of the Exploratorium Snackbook provides instructions for completing several "snacks" or classroom versions of exhibits from the San Francisco Exploratorium, a hands-on science museum. For each snack, this resource gives instructions for conducting the experiment in a classroom, listing the materials needed. The Snackbook also gives explanations of the scientific phenomena exhibited in the experiments.

MegaMath
http://www.c3.lanl.gov/mega-math/
MegaMath explores different mathematical ideas with activities and projects. For each idea, such information as vocabulary, concepts, and relevant National Council of Teachers of Mathematics (NCTM) standards are included. One project, the "Most Colorful Math of All," uses a story to interest children in the mathematical problem of coloring a map according to certain criteria. Other projects teach students about algorithms, graphs, knots, and infinity.

Newton's Apple Educational Materials
http://ericir.syr.edu/Newton/welcome.html
The Newton's Apple television series from PBS maintains this WWW site; lessons from each season of the program are included here. These lessons, on topics from dinosaurs to karate to photography to mapping the brain, illustrate science concepts through hands-on activities and experiments. Each lesson includes insights about the topic, connections to encourage classroom discussion, resources, and vocabulary. Lessons also include a main activity and several "try this" activities related to each topic.

Resources for Chem Teachers
http://rampages.onramp.net/~jaldr/chemtchr.html
This Web site for chemistry teachers of grades 9 to 12 provides teacher-contributed lesson plans, information sheets, and other resources for teachers to use. Active learning resources on this site include labs and demonstrations for two different levels of chemistry classes. This site will aid both students and teachers in conducting experiments and leading demonstrations in the classroom.

The Weather Unit
http://faldo.atmos.uiuc.edu/WEATHER/weather.html
Developed for grades 2 to 4, this teaching unit presents lessons on such topics as precipitation, temperature and temperature variations, rainstorms, and climate. The unit is made up of math, science, reading and writing, social studies, geography, music, drama, and physical education activities. Each activity in the unit includes prerequisites, objectives, needed materials, background information on the topic, the procedure, conclusion, vocabulary words, evaluation, and follow-up lessons.

What Makes Music?
http://sln.fi.edu/~helfrich/music/intro.html
This educational supplement to a traveling exhibit about what makes music is part of the virtual museum at the Franklin Institute Science Museum. This Web site contains educational resources, activities, and lessons. For example, a section on sound perception contains several activities about acoustics and psychoacoustics. A "Name that Tune" activity plays songs from different eras and explains more about how people use their brains when they identify songs.

Promising Practices for Active Learning

The 10 Eisenhower Regional Consortia have produced a publication that highlights 50 promising practices in mathematics and science education. *Promising Practices in Mathematics and Science Education-1995* was developed from a nationwide search and review process conducted by science and mathematics teachers and reviewers from various organizations, associations, and educational institutions. These innovative practices are intended to serve as models for improving teaching and learning in mathematics and science classrooms across the country.

With the cooperation of the Consortia, this issue of *ENC Focus* highlights three of the promising practices that are relevant for active learning with hands-on resources. For more information about *Promising Practices*, contact one of the ten Regional Consortia listed on the inside back cover of this catalog. In addition, the entire publication is available through ENC Online.

K-6 Science and Mathematics Enhancement Program (KSAM)

This teacher inservice and materials-development effort has been implemented on a statewide basis in Missouri, 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's approach to meeting this objective is to provide 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. 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 weathering of rock, students learn that movement of rocks in water causes rocks to wear down. By shaking rocks and water in a plastic bottle, students simulate the action of rocks being moved by water. Little bits of rock, broken away by the shaking action, found in the water illustrate that rocks moved by water are broken and worn down.

For more information, contact: Dr. Ernest L. Kern, Project Director, Southeast Missouri State University, KSAM Program, One University Plaza, Cape Girardeau, MO, 63701, Telephone no.: (314) 651-2593/Fax: (314) 651-2223

National Engineering Design Challenge (NEDC)

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, 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 that result in an interdisciplinary course involving math, science, and technology. Key to the success of the program is using advising engineers and other resources in the community.

For more information, contact: Dr. Theodore J. Gourley, Associate Director, Educational Information and Resource Center, 606 Delsea Drive, Sewell, NJ, 08080, Telephone no.: (609) 582-7000/Fax: (609) 582-4206

Nitty-Gritty, Down and Dirty Science Carnival

This school-wide, hands-on learning event is 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. Twelve learning stations are set up, and the children advance through a series of stations staffed by station masters, who are 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. All teachers are given a copy of the science carnival manual listing all experiments so that they can easily implement the experiments in their classrooms following the carnival.

For more information, contact: Ms. Maureen Trimble, School Secretary, English Estates Elementary School, 299 Oxford Dr., Fern Park, FL, 32730, Telephone no.: (407) 831-1416/Fax: (407) 831-6024

Other Federal Projects and Resources

Many Federal programs encourage active learning through internships and field experiences. For more information about Federal education in mathematics and science, consult ENC's *Guidebook to Excellence*, available in print or online.

Cargo for Conservation

Cargo for Conservation is a wildlife education program focusing on the impact of illegal/mismanaged wildlife trade on Federally protected animal and plant species. Hands-on wildlife items (parts and products confiscated by the U.S. Fish and Wildlife Service at U.S. ports of entry) are included with supplemental written materials. The written materials are designed for grades 4-8 but can be used effectively with older audiences. The program, available for loan to educational institutions, is sponsored by the U.S. Fish and Wildlife Service in cooperation with the Union Camp Corporation, the National Wildlife Federation, and the National Fish and Wildlife Foundation.
National Fish and Wildlife Forensics Laboratory
U.S. Fish and Wildlife Service
1490 East Main Street
Ashland, OR 97520
Telephone no.: (503) 482-4191/Fax: (503) 482-4989

Infusing Aquaculture Into Agriculture Education

Through Congressional appropriations in 1990-1993, USDA initiated a pilot program to develop materials, conduct field tests, and provide training in aquaculture for selected teachers across the country. The curriculum is proving valuable in teaching high school students the principles of science and mathematics related to aquatic organisms. The program is being adapted by some schools for middle and elementary students.
Grants Program Manager
Office of Higher Education Programs
Cooperative State Research Service
U.S. Department of Agriculture
Aerospace Building, Room 310-E
901 D Street SW.
Washington, DC 20250-2251

National Science Center

The National Science Center, sponsored by the Department of Defense, is designed to increase interest in science and mathematics among students, improve the skills of teachers, and provide scientific curriculum materials to the classroom. The Center holds summer workshops for both students and teachers in electronics and electrical engineering. One major element of the National Science Center is the Discovery Center, which is devoted to communications and electronics technology.
National Science Center/Attention: ATZH-NSC-D
Building 25722
Fort Gordon, GA 30905-5689
Telephone no.: (706) 791-7621

New Explorers

DOE and Argonne National Laboratory support formal and informal initiatives in conjunction with the Public Broadcasting System production of "The New Explorers with Bill Kurtis." The program includes student activities, curriculum materials, scientific field trips, and career information that support classroom use of the video. New Explorers partners are active across the country developing teacher guides relevant to local environments.
U.S. Department of Energy
Office of Science Education and Technical Information, ET-3
1000 Independence Avenue SW
Washington, DC 20585
Telephone no.: (202) 586-8949/Fax: (202) 586-0019

Research Apprenticeship Program

The Research Apprenticeship Program provides summer employment in university and Federal research laboratories for high school students having strong mathematics and science aptitude. One-fourth of the students receive Federal support; the remainder are supported by State and private funds leveraged by the Federal partner. Many research apprentices are females or minorities. Participants interact directly with scientists at USDA laboratories and gain valuable experience in agricultural science.
Special Programs Manager
U.S. Department of Agriculture
Agricultural Research Service
Administration Building, Room 337-A
14th Street and Independence Avenue SW
Washington, DC 20250-0300
Telephone no.: (202) 720-6161/Fax: (202) 690-0109

Summer High School Apprenticeship Research Program (SHARP)

The objective of the SHARP Program is to channel students that traditionally have not been represented into the fields of mathematics, science, and engineering. Selected students participate in intensive science and engineering research at a NASA Field Center as an apprentice to a NASA mentor in a related research area. To be selected, students must have a demonstrated interest and aptitude for science, mathematics, and technology-related areas and live within commuting distance of a NASA Field Center.
Elementary and Secondary Branch
Education Division
Code FEE
NASA Headquarters
Washington, DC 20546
Telephone no.: (202) 358-1518

Please Send Me the Following Free ENC Materials:

- ❑ *ENC Focus – Integrating Math and Science*
- ❑ *ENC Focus – Real Data Resources*
- ❑ *ENC Focus – Earth Day in the Classroom*
- ❑ *ENC Online Quick Reference Brochure*
- ❑ CD-ROM Request Form
- ❑ *ENC Submission Form*
- ❑ *ENC Update* (future issues)
- ❑ *Guidebook to Excellence* A Directory of Federal Programs

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Your Position(s): _____

School or Institution: _____ State: _____

Mailing Address: _____

_____

_____ (City) ____ (State) _____ (ZIP) – _____ (ZIP+4)

Phone: (_____) _____ Fax: (_____) _____

E-mail Address: _____ On What Network or System? _____

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❑ A curriculum specialist
❑ A school administrator
❑ A district administrator
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❑ A teacher educator
❑ A college faculty member
❑ Other _____

Is your area:
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❑ Mathematics education
❑ Elementary education
❑ Some other area _____

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Directory of Eisenhower Mathematics and Science Regional Consortia

Appalachia Region
Eisenhower Regional Math/Science Consortium at AEL
Appalachia Educational Laboratory
P.O. Box 1348
Charleston, WV 25325-1348
Phone: (800) 624-9120/Fax: (304) 347-0487
States Served: Kentucky, Tennessee, Virginia, West Virginia

Central Region
Eisenhower High Plains Consortium for Mathematics and Science
Mid-continent Regional Educational Laboratory
2550 South Parker Road, Suite 500
Aurora, CO 80014
Phone: (303) 743-0990 or (800) 949-6387
Fax: (303) 337-3005
States Served: Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota, Wyoming

Mid-Atlantic Region
Mid-Atlantic Consortium for Mathematics and Science Education
Research For Better Schools, Inc.
444 North Third Street
Philadelphia, PA 19123-4107
Phone: (215) 574-9300 ext. 327/Fax: (215) 574-0133
States Served: Delaware, Washington DC, Maryland, New Jersey, Pennsylvania

Midwestern Region
Midwest Consortium for Mathematics and Science Education
North Central Regional Education Laboratory
1900 Spring Rd., Suite 300
Oak Brook, IL 60521-1480
Phone: (708) 571-4700/Fax: (708) 571-4716
States Served: Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, Wisconsin

Northeast and Islands Region
Eisenhower Regional Alliance for Mathematics and Science Education Reform
TERC
2067 Massachusetts Avenue
Cambridge, MA 02140
Phone: (617) 547-0430/Fax: (617) 349-3535
States/Areas Served: Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, Puerto Rico, Virgin Islands

Northwest Region
Science and Mathematics Consortium for North West Schools
Columbia Education Center
11325 SE Lexington
Portland, OR 97266-5927
Phone: (503) 760-2346/Fax: (503) 760-5592
States Served: Alaska, Idaho, Montana, Oregon, Washington

Pacific Region
Pacific Mathematics and Science Regional Consortium
Pacific Region Educational Laboratory
828 Fort Street Mall, Suite 500
Honolulu, HI 96813
Phone: (808) 533-6000/Fax: (808) 533-7599
States/Areas Served: American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia (Chuuk, Kosrae, Pohnpei, Yap), Guam, Hawaii, Republic of the Marshall Islands, Republic of Palau

Southeastern Region
SERVE Eisenhower Consortium for Mathematics and Science Education
SouthEastern Regional Vision for Education
345 South Magnolia Drive, Suite E-22
Tallahassee, FL 32301-2950
Phone: (904) 671-6033/Fax: (904) 671-6010
States Served: Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina

Southwestern Region
Southwest Consortium for the Improvement of Mathematics and Science Teaching
Southwest Educational Development Laboratory
211 East Seventh Street
Austin, TX 78701-3281
Phone: (512) 476-6861/Fax: (512) 476-2286
States Served: Arkansas, Louisiana, New Mexico, Oklahoma, Texas

Western Region
Far West Eisenhower Regional Consortium for Science and Mathematics Education
Far West Laboratory for Educational Research and Development
730 Harrison Street
San Francisco, CA 94107
Phone: (415) 241-2730/Fax: (415) 241-2746
States Served: Arizona, California, Nevada, Utah

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