Eisenhower Southwest Consortium for the Improvement of Mathematics and Science Teaching

Classroom Compass

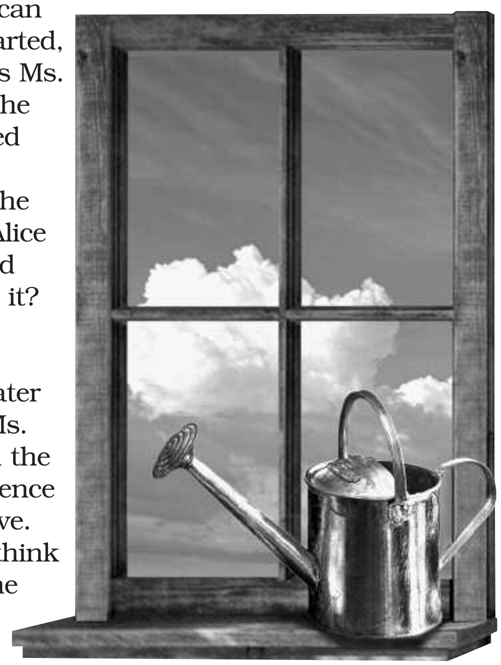
Fall 1995 • Volume 2, Number 1

Where Did the Water Go?

Mary Alice was annoyed. The watering can had water in it when she left it on the window sill on Friday, but it was empty on Monday morning. She didn't have time to fill the can before class started, and, as soon as Ms. Wilson began the class, she raised her hand.

"Who used the water?" Mary Alice demanded. "Did someone drink it? Or spill it?"

No one had touched the water since Friday. Ms. Wilson realized the class had a science question to solve. "What do you think happened to the water?" she asked.



Jennifer had an ingenious explanation. "I bet Willie the hamster got out of his cage and drank it. We could prove it by covering the can and see if the water level goes down the next day."

"I don't think Willie can get out of his cage," said José. "Let's figure out a way to know what he does at night. Maybe we could put his cage on the sand table and see if he leaves footprints."

Before leaving, the class covered the watering can and smoothed down sand around Willie's cage. The water level remained the same and no little paw prints appeared in the sand.

"But wait," said Kahena. "Why should Willie get out of his cage? He can see the can is covered. Let's leave it uncovered and see what happens."

So the class again left the cage in the middle of the sand table but left the cover off the can. It took several days for the water level to drop, but it did go down, and there were still no footprints in the sand. By this time, the children were willing to let go of their original idea about the water's disappearance, and Ms. Wilson suggested an alternative experiment: "Let's put a jar of water in the window sill and measure it each day with paper slips to see if we can learn

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Science and

Ms. Wilson found a way to help her students connect science to their lives. Years from now, many of them will still link their understanding of evaporation to their experiments with the watering can and the conversations that ensued. Understanding the whys and hows of that event helped the children build skills that will support them all their lives.

There is little doubt that the future will be filled with science and mathematics. Rapid advances in computer technology, the infusion of complex mathematics in economics, and the influence of science on health and medicine are but a few examples from today's society. Once thought by some to be the realm of an intellectual elite, science and mathematics are part of everyone's life. Students' success as adults will be influenced by their ability to observe, interpret, and understand their surroundings. Education's challenge is to instill the underlying concepts of science and mathematics in all students so they can construct their own foundations and continue to learn throughout their lives.

Make It Real

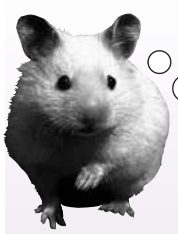
To begin to build that lifelong foundation, students must view science and mathematics with interest and enthusiasm. Teachers can nurture intellectual excitement by linking classroom activities with real life. While some learners work well with abstract ideas, for most of us understanding is enhanced when it is linked to a familiar experience. While many textbooks and instructional activities provide interesting theoretical suggestions, taking those theories and applying them to student experiences can test a teacher's ingenuity.

Trips to the grocery store, a bicycle or rollerblade ride, making and spending money, or exploring the shapes of homes, local businesses and the school building—all have potential for mathematics questions. The environment within and outside the classroom (local streams and geologic formations, pet behavior, observations of the sun or the moon) can help convey the immediacy of science. A "star party" is a great way to engage students in observation and exploration of the night sky. If your school is connected to the Internet, hook into a meteorological site that provides reports of weather patterns across the country or around the world. Many excellent instructional materials pose questions and suggest activities that can be tied to the local environment. Build your lessons around them with a thought of how familiar and immediate they will be to your students.

Questions Uncover Understanding

How do we know what students are learning? How do we know what they bring to the classroom? What are their thoughts and theories? Finding the right questions and the ways to ask them is the essence of the art of teaching. The structure of a teacher's questions determines the pace of a lesson, the direction inquiry will take, and the balance of autonomy between the teacher and students. Questions that probe for further explanations help students construct and articulate their understanding. They also help the teacher grasp what they understand. Ask how ideas fit with the observable evidence. Have they had other experiences that support their ideas? Do others have alternative experiences or alternative ideas?

Conversations should occur among students, as well as with the teacher. Student-based questions—questions they pose in discussions or to the teacher—provide insight to their understanding. Give them enough thinking time, "wait time," to reflect and gather a response. Students who can explain their



Where Did the Water Go?
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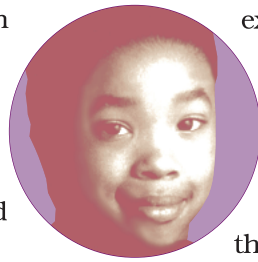
anything from the water's changes," she said.

After several days of observation, the students saw a pattern: the water was falling steadily but did not decrease the same amount each day. When they tried a differently shaped container, the rate changed. As the children worked toward developing an understanding of the influence of surface area and air temperature on evaporation rates, they discussed and predicted results of experiments they designed themselves.

This scenario has been adapted with permission from the *Draft National Science Education Standards.* Copyright 1994 by the National Academy of Sciences. Courtesy of the National Academy Press, Washington, D.C.

ideas may be able to present a concept in a new and more understandable way, for themselves and their classmates.

Small groups focused on a particular question can offer a safe environment for discussion and problem solving. A classroom with a level of comfort about ideas, reflection, and disagreement encourages curiosity and inquiry. Permission to speculate and contribute is one way of opening the inquiry of science and mathematics to all. Knowing Willie was probably not the water culprit, Ms. Wilson supported the students' exploration into his nocturnal habits. Without the permission to explore their ideas, the class would not have progressed to the next steps of looking at evidence, rethinking, and gathering new evidence. Everyone can benefit from the class's collective experiences and understandings of the world around them.



What to Teach?

One of the challenges of teaching mathematics and science is the breadth of subject matter. How can educators accommodate the call for "Less Is More" and adequately address the content of the disciplines? The authors of *Benchmarks for Science Literacy* state: "The common core of learning in science, mathematics, and technology should center on science literacy, not on an understanding of each of the separate disciplines." The authors note that learning experiences must include connections among science, mathematics, and technology, as well as the arts, humanities, and vocational subjects.

As an example, younger children can understand the relation between heart rate and exercise if they are given the time to explore. Drawing pictures of the heart or memorizing the names of the heart's chambers will not provide such depth or experience. The connections that link their learning to larger themes such as living systems (how hearts work inside living bodies), social issues (the effects of air pollution or smoking), or health (the influence of diet and exercise on the heart) are the beginning of real science literacy. Mary Alice's questions about the disappearing water could lead the class to an examination of weather patterns, energy and matter, or the importance of measurement in scientific inquiry. Ms. Wilson could choose any one of these avenues (but not all three!) to provide a larger picture for understanding evaporation. The definition of evaporation, while probably one outcome of the examination, is but a piece of the puzzle.

Equity in the Classroom

By using her questioning skills, giving the children's imagination free rein in the early stages of theorizing, and focusing their activity on one investigation, Ms. Wilson set the stage for scientific inquiry. The experiment, as it extended over time, gave the students the chance to reflect and discuss their ideas. Each child was encouraged to contribute, to bring individual theories, observations, and conclusions to the problem. By taking each child's response seriously and letting the students design the experiments to explore the problem, Ms. Wilson demonstrated respect for diverse backgrounds and experiences while acknowledging their different levels and abilities.

Our classrooms are filled with diversity. They challenge teachers who are striving to introduce all students to the excitement and power science and mathematics can bring. The *Curriculum Standards* from the National Council of Teachers of Mathematics (NCTM) say it well:

> "...today's society expects schools to insure that all students have an opportunity to become mathematically literate, are capable of extending their learning, have an equal opportunity to learn, and become informed citizens capable of understanding issues in a technological society. As society changes, so must its schools."

Ms. Wilson's story presents the basics of equity in its evenhanded acceptance of the children's ideas. Specific questions of ensuring participation ("How do I get more girls in the computer lab?" "How do I design activities that include my physically handicapped youngster?" "What about the wide range of abilities in my class?") are addressed in many publications from many different organizations. See the reading list, *Equity in Science and Mathematics Education* on page 10, for further ideas.

Benchmarks for Science Literacy by Project 2061 of the American Association for the Advancement of Science (AAAS). Published by the Oxford University Press, 1993.

Curriculum and Evaluation Standards for School Mathematics by the National Council of Teachers of Mathematics (NCTM). Published by NCTM, 1989.

National Science Education Standards by the National Research Council (NRC). Published by National Academy Press, 1995 (projected).

Science As Inquiry: Early Grades

The following excerpts (pages 4 and 7) are from a draft version of the *National Science Education Standards.* These particular sections present guidelines for the development of science inquiry skills from kindergarten to grade 12. The accompanying activities, "Howdy Heart" and "The Pendulum," suggest ways to foster student inquiry in the classroom.

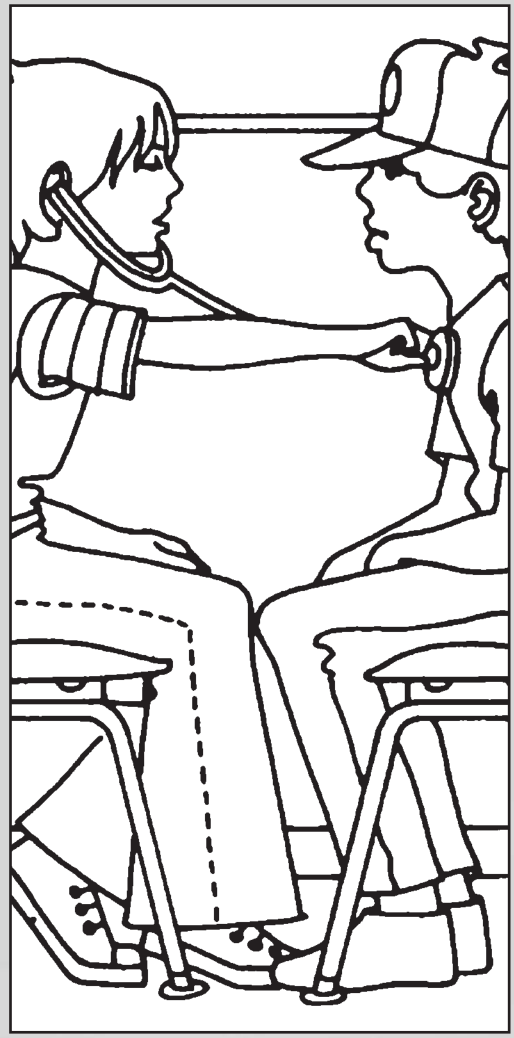
Content Standard for Grades K–4: Science as Inquiry

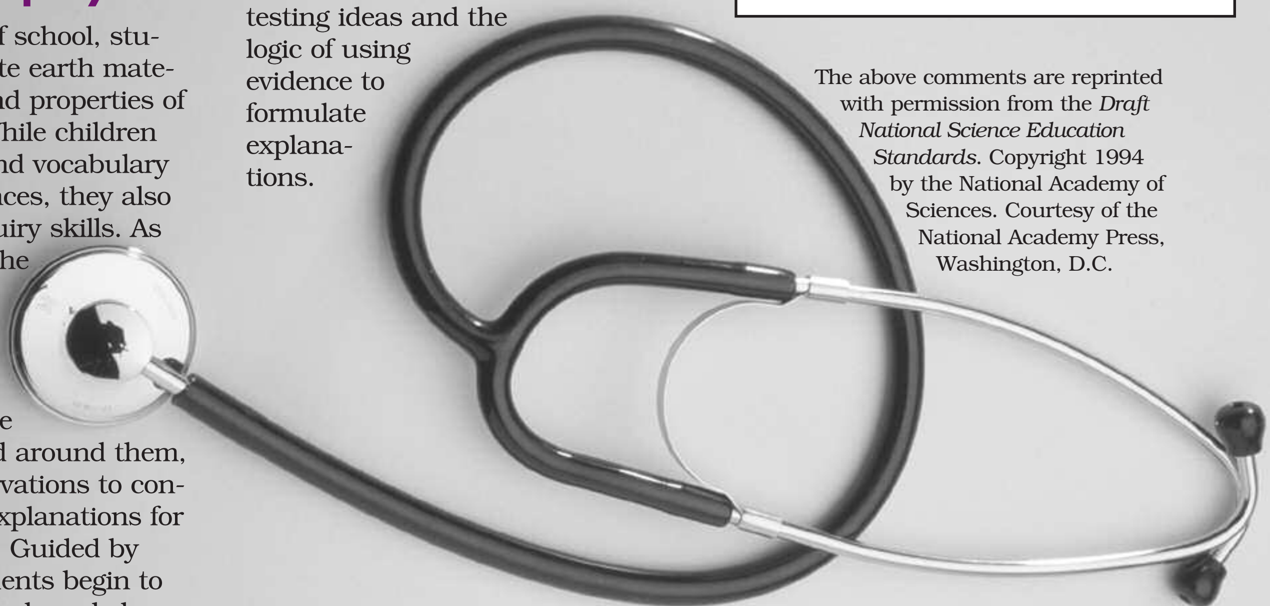
In the early years of school, students can investigate earth materials, organisms, and properties of common objects. While children develop concepts and vocabulary from these experiences, they also should develop inquiry skills. As students focus on the processes of doing investigations, they develop the ability to ask a scientific question, investigate aspects of the world around them, and use their observations to construct reasonable explanations for the question posed. Guided by their teachers, students begin to develop their science knowledge.

As part of the inquiry process, students should also learn how to communicate their investigations and explanations and those of others.

Although there is logic to the abilities outlined in this inquiry standard, a step-by-step sequence or "scientific method" is not implied. In actual practice, student questions may arise from their previous investigations, planned classroom activities, or questions they ask each other. For instance, if children ask each other about how animals are similar and different, an investigation might arise into characteristics of organisms they can observe.

Full inquiry involves asking a simple question, completing an investigation, answering the question, and presenting the results to others. In general, elementary students are developing the physical and intellectual skills of scientific inquiry. They can design investigations to try things to see what happens—they will focus on concrete results of tests and even entertain the idea of a "fair" test, a test in which only one variable at a time is changed. They may have difficulty with experimentation as a process of testing ideas and the logic of using evidence to formulate explanations.





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Howdy Heart

An Activity for Younger Children

Young children are fascinated with the sound of their own hearts. In this activity pairs of early elementary students investigate that intriguing sound and explore the effect of exercise on heart rate. In this experiment they will gather data, make comparisons, and report their results.

This activity allows students a peek into their own bodies and gives them a way to quantify their observations. As an example of "Less is More," it allows a young child access to the basics of scientific investigation through a simple and immediate activity. In later lessons, connections could be made to understanding the human body, ways of presenting data, or information on health and fitness.

Questions will emerge as the students explore with the stethoscopes.

- **What sounds did they hear as they examined the room?**
- **What situations increase heart rate?**
- **Does anyone have an example from personal experience?**
- **We see that exercise increases heart rate, what else (what other *variables*) might affect it?**
- **How could we test for these other *variables*?**

The comparison of resting and active heart rates provides an opportunity to introduce the ideas of *variable* and *controlled experiment*. Explain that the experiment started with one condition (the resting heartbeat), that was changed so we could compare different situations. That change made the activity more than a simple observation; it became an experiment.

Use the words *variable* and *experiment* in the discussion. It is not important that the children build their vocabulary with these words, but they can begin to think about comparing and recording observations, controlling variables to enable comparison, and drawing conclusions from data.

Begin by letting each student hold, listen with, and explore with a stethoscope. Caution the children not to yell into, bang, or squeeze the diaphragm of the scope. Stethoscopes magnify sounds and such actions could hurt or injure the wearer's ears. Students can practice wearing the stethoscopes (the hose from the diaphragm goes to the right ear) and examine the classroom, listening for sounds in usual and unusual places (clocks, windows, walls). The user should clean the earpiece with an alcohol pad before another uses the scope.

The heart makes a double beat that sounds like "lub-dub." Tap the sound on the underside of a table while the children listen with their scopes. Each "lub-dub" counts as a single heartbeat. The students can practice counting the tabletop heartbeats, starting with three or four taps and working up to 15.

Experimenting and Recording

Now it is time to locate and listen to human heartbeats. First, the students listen to each other's hearts. Allow enough time to be sure everyone can hear and identify the beat. The students will measure heart rates for a 15-second interval. Let them practice counting the heartbeats for a timed 15-second interval, then let them "officially" count the number of heartbeats and record the beats. Students then switch roles and repeat. Ask each pair to report their findings on their recording sheet. These numbers provide the data for measuring a "resting" heart beat.

You will need:

- Stethoscopes, one for each student pair
- Cotton pads and alcohol for cleaning the earpieces
- A recording sheet for each student pair with columns for the resting and active heart rates.

Introducing the Variable

What makes our hearts beat fast? How can we make our hearts beat faster? To determine if exercise changes the rates just measured, one student exercises (runs in place or does jumping jacks) for one minute. The partner then counts the heart rate for 15 seconds and records the result. Give the "start" signal and warn the listeners to get ready with their stethoscopes. When the minute is up, give the "count" signal and the students measure heartbeats for 15 seconds. Have the counter record the heart rate and then let the students switch roles.

Comparing Results

Upon completion of the exercise, let each pair report its results on a data table, drawn on the blackboard with columns for resting and active heart rates.

This activity is adapted from the SAVI/SELPH activity "Howdy Heart," one of five activities in the Scientific Reasoning Module developed by the Center for Multisensory Learning, Lawrence Hall of Science, University of California, Berkeley CA 94720, (510) 642-8941.

The Pendulum

An Activity for Older Students

This activity combines a basic physics demonstration with algebraic concepts.

While this experiment does not arise from an everyday problem, ask the students to think of other ways pendulums are used—perhaps a tire swing, a wrecking ball, or a circus trapeze. How would the experiment's results influence the design of those pendulums?

This activity is designed to ensure active participation by all the students. Switch partners to let each person swing, count, and report.

Allow the groups time to discuss such questions as the role of string lengths, how far back to pull the washer, and cutting the additional string. Differences that emerge during the reporting period can be used as discussion points about data collection (How accurate must data be to assure usable results? If we count the swings differently, can we compare the counts?) and the collaborative nature of scientific investigation.

Assessment is built into this activity through teacher questions and student discussions. Predictions and conjectures challenge students to consider additional possibilities or aspects of a situation while analyzing given information and reconsidering its implications.

This activity is adapted from *Facilitating Systemic Change in Science and Mathematics Education: A Toolkit for Professional Developers*, a publication of the Regional Educational Laboratories, available from NEIRL, 300 Brickstone Square, Suite 950, Andover, MA 01810. Thanks to Diane McGowan, mathematics instructor at James Bowie High School and David Molina, Department of Curriculum and Instruction, the University of Texas, for their recommendations in adapting this activity.

Give each pair of students a washer and a length of string (make sure the strings vary in length) and have them tie the washer to the string, knotting the string at the end. Let them practice counting pendulum swings. One student holds the string by the knot and swings the pendulum while the other student counts the swings. One swing is counted each time the pendulum crosses the center front of the swinger's body. How many swings would occur in 20 seconds? Time a 20-second interval and let the students count the swings. Allow the students to switch roles and do the count again. If the counts are substantially different, a third trial should be made to verify the count.

Have students form groups of four (2 pairs). Ask them to measure the string lengths from the knots to center of the washers and record that number. They will tape the pendulums to the number line on the wall, matching the number of swings to the number on the line. The knot should be taped exactly on the line. The washers on the varying lengths of string will produce a pronounced curve under the number line. What does that curve show us? Are there other ways of presenting the relationship between the length of string and the number of pendulum swings?

Draw a two-column table on the board and ask each group of four to report the recorded string length and swing count of its two pendulums. Compare and discuss the results of the pendulum swings. A graph can provide another picture of the relation between the two variables.

You will need:

- Three identical metal washers for each pair of students
- A metric ruler for each pair of students
- Cotton string cut in varying lengths—One length for each student pair (Variations in string length make this activity more effective)
- Additional string
- Scissors
- A number line marked from 10 to 30 attached to the classroom wall

Distribute graph paper to each group so they can plot the class data displayed on the board.

What happens if we double the string length (2x) or cut it in half (0.5x)? What shape will those lengths produce on the number line? How will they plot on a graph? Distribute two more washers to each pair and have the students cut 2x and 0.5x length strings. Tie and knot those pendulums and time another series of 20-second counts with both new lengths. Let the groups tape the new pendulums to the number line. Are the students' predictions correct? Are there variations in the curve? How important is it to cut the 2x and 0.5x lengths exactly? Now that we've seen a 2x length, what would a 3x length produce?

What other variables affect pendulum behavior? Would a heavier washer give the same number of swings in 20 seconds? What if the washer is initially dropped from a higher or lower point? How long would the pendulum continue to swing on its own? Test these questions as time permits.

Science As Inquiry: Middle Grades and High School

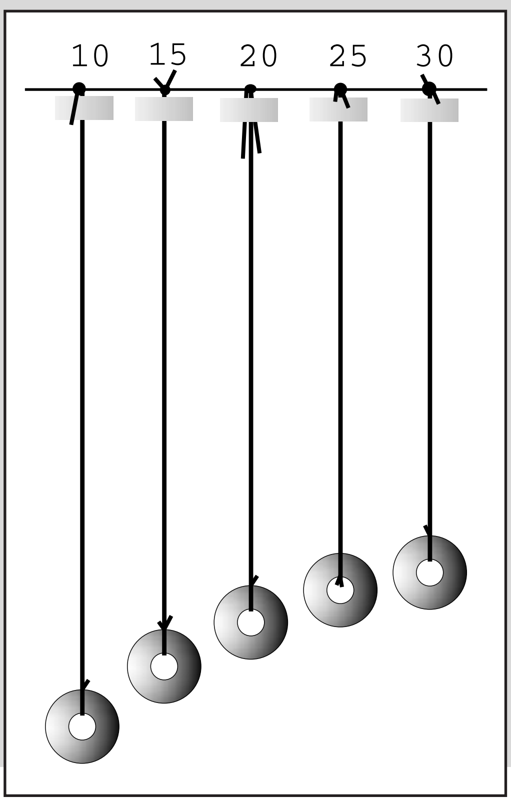
Content Standard for Grades 5–8: Science as Inquiry

Students in grades 5–8 should be provided opportunities to do science in the complete sense. They should have some experiences where they begin with a question, design an investigation, gather evidence, formulate an answer to the original question, and communicate the investigative process and results.

At grades 5–8, students can begin to recognize the relationship between explanation and evidence—that background knowledge and theories guide the design of investigations, the types of observations, and the interpretations of data. In turn, the experiments and investigations students conduct become experiences that shape and modify their background knowledge.

Teachers of science for middle school students should note one very important research finding. Students tend to center on evidence that confirms their current beliefs and concepts (personal explanations) and ignore, or fail to perceive, evidence that varies from their current conception. It may be important for science teachers to challenge current beliefs and concepts and provide scientific explanations as alternatives.

Oral or written reports that present the results of the inquiry should be a frequent occurrence in science programs during the middle years. To help focus student thinking, their discussions should center on such questions as "How should we organize the data to present the clearest answer to our question?" or "How should we organize the evidence to present the strongest explanation?" An important element of doing inquiries is the language and practices evident in the classroom. Students need opportunities to communicate scientific explanations and ideas or otherwise use the knowledge and language of science.



Content Standard for Grades 9–12: Science as Inquiry

In grades 9–12, students should develop a greater sophistication in their abilities and understandings of scientific inquiry. The challenge to teachers of science and to curriculum developers is identifying contexts that make science investigations meaningful for students. Student questions about current scientific topics are one source of meaningful investigations. Actual science and technology-related problems provide another source of investigations. Finally, teachers of science should not overlook the fact that some experiences that begin with little relevance for students can develop meaning through active involvement, exposure, skill, and understanding.

Public discussions of the students' proposed explanations, and peer review of investigations replicate an important aspect of science. Talking with peers about their experiences with science helps students develop meaning and understanding. Their conversations clarify the concepts and processes of science; the conversations help them make sense of science content and methods.

Science teachers should engage students in conversations that focus on questions, such as "How do we know?" "How certain are you of those results?" "Is there a better way to do the investigation?" Questions like these make it possible for students to analyze data, develop a richer knowledge base, reason using science concepts, make connections between evidence and explanations, and recognize alternative explanations. Ideas should be examined and discussed in class so that other students can benefit from the feedback. Teachers of science can use the ideas of students in their class, they may use ideas from other classes, and they may use ideas from texts, databases, or other sources, but scientific ideas and methods should be discussed.

Resources and Opportunities

Investigations in Number, Data, and Space

Try to envision a small group of third graders working around a table with several manipulative materials, talking about whether to use multiplication or division to solve a problem. The students might be working from a new program entitled *Investigations in Number, Data, and Space* offered by Dale Seymour Publishers. This inquiry-based mathematics curriculum, currently available for grades 3 and 4, presents activity books with background and preparation information, lesson plans, reproducible teaching materials, teacher notes, and an assessment plan. Students work together, using concrete materials and technological tools, talking, writing, and drawing about math, finding multiple approaches to problems, and inventing their own strategies. Several of the books include activities for use with Geo-Logo software, which is included.

At present, *Investigations in Number, Data, and Space* provides 21 separate books, 10 for grade 3 and 11 for grade 4. They may be purchased individually; most are $23 each. *Investigations* was developed at TERC (formerly Technical Education Research Center) in Cambridge, Massachusetts. For more information write
Dale Seymour Publications
PO Box 10888
Palo Alto, CA 94303
or call
1-800-872-1100.

Mathematics Learning Forums

The Bank Street College of Education is sponsoring a series of on-line seminars for elementary and middle school mathematics teachers. Participants from around the nation will discuss specific aspects of mathematics teaching. During the fall 1995 or spring 1996 semesters, 18 forums will be offered. Forum themes include:

- Assessing Students through Focused Observations (K–4)
- Investigating Patterns in Mathematics (5–8)
- Teaching Probability (5–8)
- Engaged Learning: When Does a Child Really Learn? (K–4)

An on-line facilitator will host the sessions and teachers will view videotapes of students and teachers in many school settings. Graduate credits and inservice credits are available for additional registration fees.

For a registration form and more information phone **(212) 807-4207**; email **cct@edc.org** or visit the Web Site at **http://www.edc.org/CCT/mlf/MLF.html**

Pathways to School Improvement

The North Central Regional Educational Laboratory (NCREL) in Oak Brook, Illinois, has prepared *Pathways to School Improvement*, an examination of reform in mathematics and science education. The *Pathways* address on the World Wide Web **(http://cedar.cic.net/ncrel/sdrs/pathways.htm)** outlines a variety of selections that include assessment, leadership, governance, and school to work. The mathematics and science sections examine such issues as providing authentic learning experiences in science, ensuring equity in science and mathematics instruction, and the significance of the NCTM *Standards*. The site provides thoughtful discussions that support educational reform for mathematics and science education.

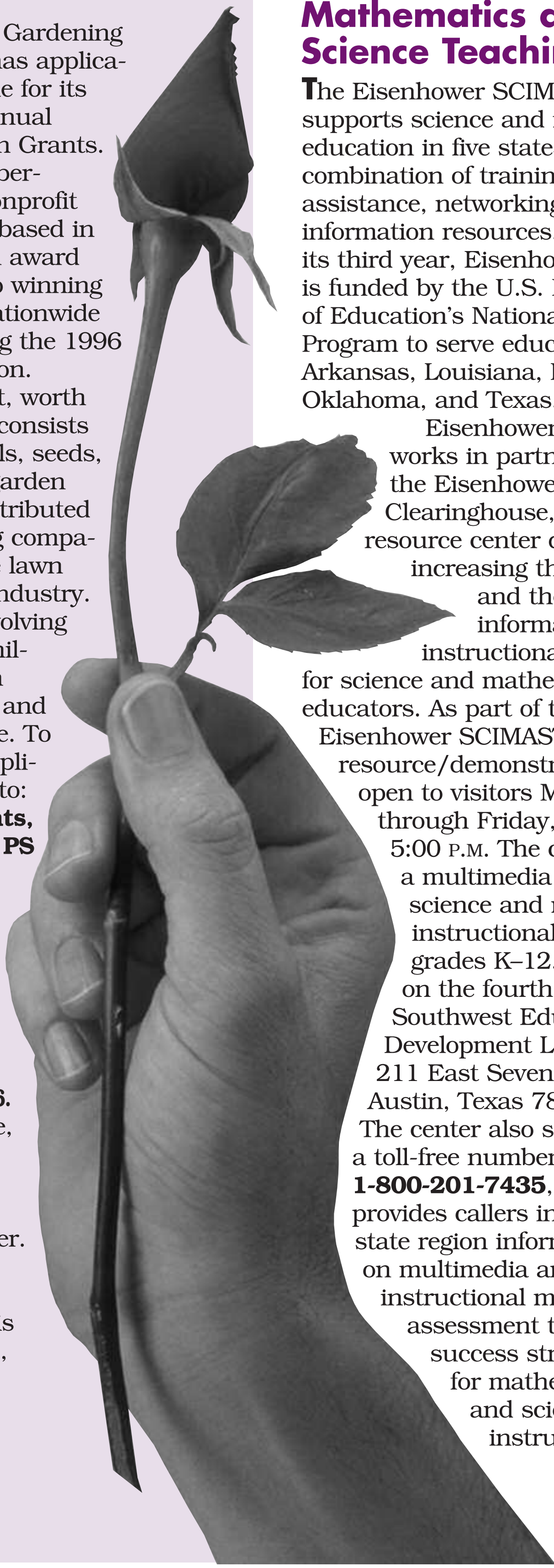
The Journey Inside: The Computer

Nothing can replace hands-on experience for learning computer skills. As an introductory segment to learning about the internal workings of the machine and the history of its development, however, this free instructional kit from Intel Corp could be helpful. The kit (pictured at left) includes instructional materials and an introductory video, but best of all is the Chip Kit: a collection of processor chips, a packaged microprocessor, and a silicon wafer. These artifacts can be passed around and closely examined without fear of breaking or contaminating them. The kit is available to teachers of mathematics, science, or computers in grades 5 through 9. To obtain an order form call **1-800-346-3029 ext. 143.**

Youth Garden Grants

The National Gardening Association has applications available for its thirteenth annual Youth Garden Grants. NGA, a member-supported nonprofit organization based in Vermont, will award 300 grants to winning applicants nationwide for use during the 1996 growing season.

Each grant, worth about $500, consists of quality tools, seeds, plants, and garden products contributed by 28 leading companies from the lawn and garden industry. Programs involving at least 15 children between the ages of 3 and 18 are eligible. To receive an application, write to: **Garden Grants, Department PS National Gardening Association, 180 Flynn Avenue, Burlington VT 05401** or call: **1-800-538-7476.** Include name, school or organization, address, and phone number. Deadline for completed applications is November 15, 1995.



S C I M A S T

Eisenhower Southwest Consortium for the Improvement of Mathematics and Science Teaching

The Eisenhower SCIMAST project supports science and mathematics education in five states with a combination of training, technical assistance, networking, and information resources. Completing its third year, Eisenhower SCIMAST is funded by the U.S. Department of Education's National Eisenhower Program to serve educators in Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

Eisenhower SCIMAST works in partnership with the Eisenhower National Clearinghouse, a national resource center dedicated to increasing the availability and the quality of information about instructional resources for science and mathematics educators. As part of that effort, Eisenhower SCIMAST supports resource/demonstration center open to visitors Monday through Friday, 8:00 A.M. to 5:00 P.M. The center houses a multimedia collection of science and mathematics instructional materials for grades K–12. It is located on the fourth floor of the Southwest Educational Development Laboratory, 211 East Seventh Street, Austin, Texas 78701. The center also sponsors a toll-free number, **1-800-201-7435**, that provides callers in the five-state region information on multimedia and print instructional materials, assessment tools, and success strategies for mathematics and science instruction.

Eisenhower Southwest Consortium for the Improvement of Mathematics and Science Teaching

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Equity in Science and Mathematics Education

A READING LIST

Equity in the Reform of Mathematics and Science Education: A Look at Issues and Solutions
by Mary Jo Powell
Available from:
Southwest Educational Development Laboratory
211 East Seventh Street
Austin, Texas 78701
Full report $21,
Executive Summary $2

A review of the literature concerning equity in mathematics and science education, this book is designed as a reference tool for those working to change policy and practices. A 30-page executive summary is available as well as the complete 185-page document.

Equity Materials in Mathematics, Science, and Technology: A Resource Guide
by Marylin A. Hulme
Available from:
Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education,
Research for Better Schools
444 North Third Street
Philadelphia, PA 19123
Free

A 35-page annotated bibliography (2nd edition: August 1994) of print and nonprint materials focused on equity in math and science. Also presents resources for career information.

Lifting the Barriers: 600 Strategies that REALLY WORK to Increase Girls' Participation in Science, Mathematics, and Computers
by Jo Sanders
Available from:
Jo Sanders
P.O. Box 483
Port Washington, NY 11050
$13.95+ 15% shipping & handling

This collection of suggestions and tips includes both simple strategies ("Use a sign-up sheet that alternates girls and boys for computer time") and more complicated endeavors ("Set up a summer mentorship program for girls in your school"). Topics include suggestions for fund-raising, field trips, extracurricular activities, curriculum ideas, and participation in contests and competitions.

"Meeting the Challenges of Diversity and Relevance"
by Margaret Schwan Smith and Edward A. Silver
Mathematics Teaching in the Middle School
September-October 1995,
Pages 442–448.

This journal article discusses mathematics instruction, relating students' experiences and interests to classroom activities. The journal is published by the National Council of Teachers of Mathematics (NCTM).

Science Equals Success
by Catherine R. Conwell
Available from Women's Education Equity Act Publishing Center
55 Chapel Street, Suite 200
Newton, MA 02158-1060
$16.00

This collection of hands-on, discovery-oriented science activities puts special emphasis on problem-solving, cooperative learning, spatial skills, and career awareness.

The SAVI/SELPH Program (Scientific Activities for the Visually Impaired/Science Enrichment for Learners with Physical Handicaps)
Lawrence Hall of Science
University of California
Berkeley, CA 94720
Telephone (510) 642-1016

The SAVI/SELPH kits, print materials, and video resources from the Center for Multisensory Learning, while originally designed for disabled students, have been found to have "significant application in regular upper-elementary classrooms" (SAVI/SELPH brochure). The reasonably priced packets and videos include activities that focus on communication, environmental energy, kitchen interactions, magnetism and electricity, mixtures and solutions, scientific reasoning, structures of life, and measurement. Materials kits that provide the "stuff" of scientific investigation (basins, water jugs, washers, string, etc.) are available for purchase or rent. Call for a catalog with specific price listings.

Science Teams: Elementary Teachers and Students Discover Environmental Science Through Cooperative Learning
by Aleta You Mastny, Sami Kahn, and Sharon J. Sherman
Available from:
Consortium for Educational Equity
Rutgers University
Bldg. 4090, Livingston Campus
New Brunswick, NJ 08903
$150.00

A teacher's manual accompanies a videotape presenting ideas for using cooperative learning in the elementary science classroom with a particular focus on encouraging girls and minority students.