FALL 1999
**NO. 14**

*Lawrence Hall of Science*
*University of California*
*at Berkeley*

*Delta Education, Inc.*

# FOSS™

**FULL • OPTION • SCIENCE • SYSTEM**

# FOSS™ NEWSLETTER

In this issue:



## Announcing the FOSS 2000 Revision! FOSS for Grades 3–6 Makes a Giant Step Forward

We did it! We did it because it was time. The FOSS program for grades 3–6 was a decade old, and it had successfully brought inquiry-based science to thousands of teachers and their students around the country. During those ten years there were new developments in science education nationally and changes in the structures of school systems that FOSS needed to address. So we assembled a decade's worth of feedback and commentary from FOSS educators, reviewed the current status of elementary science education, looked ahead to the projected needs of the next generation of students and teachers, and got to work.

The schedule we imposed on ourselves to accomplish the job was daunting—essentially one year. To produce the kind of reinvigorated FOSS that we envisioned, we knew we'd need more horses pulling the wagon. We started calling in the troops to get the project moving.

Larry Malone, Linda De Lucchi, Larry Lowery, and Sue Jagoda, original directors and

*Continued on page 2*

authors of the FOSS program, were on stage and ready. We called Kathy Long back from Birmingham, invigorated from a leave to complete her PhD. We called in Leigh Agler from her hiding place somewhere up in Puget Sound, captured Denise Soderland, FOSS teacher par excellence, from southern California, and invited Laura Louttit, FOSS professional developer, on full time. Marshall Montgomery was there to help us improve equipment and design new components. (Be sure to check out the tone generator in the Physics of Sound Module.) We hired Carol and Joanna to do the graphic design, Rose to produce the illustrations again, assisted by Sandra, and Mark to help Cheryl hold the whole operation on the ground. John Quick, the original filmmaker for the teacher preparation videos, was contracted, and Eileen Massey, ex-FOSS salesperson, now a classroom teacher, was called in to direct the video production. And joy of joys, Joann, our one and only FOSS editor, was available with her green pens ready to correct the score. We had the band back together.

We had additional help as well. We had a crew of writers producing the *FOSS Science Stories* lyrics and the ScienceView multimedia development group adding the website color to the program. And most important were the teachers and students who informed the new revised procedures, tested the assessment materials, and allowed the FOSS team into their classrooms to document the learning.

Throughout the process we had the vigilant attention of the Delta executive crew—Stefan, Mathew, Jeanette, Bonnie, Grant, Dave, Tom—watching the developing products, giving advice, and supporting the revision any way they could. Delta's commitment to the revision made it possible.

Our mission was to produce a modernized version of the same old FOSS. You can still recognize the taste of classic FOSS in the revision. But there are significant and important changes as well.

Here's a selection of the revised features:

- ❍ New, more attractive, easier-to-use teacher guide. You'll like the reorganization, graphic features, and additional teacher support incorporated into the teacher guides.
- ❍ Revised, expanded assessment component for each 3–6 module.
- ❍ New *FOSS Science Stories*—student books written specifically for each revised module.
- ❍ A new website—www.fossweb.com—to extend the FOSS experience into the electronic age. FOSSweb provides interactive learning experiences as well as a host of communication and research opportunities at school or at home.
- ❍ New teacher preparation videos for all of the modules for grades 3–6, including more classroom footage of students engaged in the investigations.
- ❍ Slightly modified student equipment kits. Some items were changed and a few new items were added, but by and large the kits remain pretty much the same as they always were.

That's a snapshot of what we labored over last year. We're pleased with the result. Now it's available to you. The next several articles describe the revision features in a little more detail, and the options for upgrading your existing FOSS program or starting a new FOSS implementation.

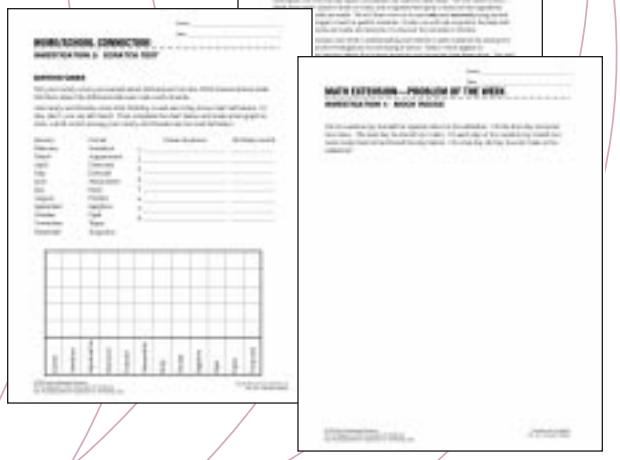
## Teacher Guide:
## Much More than a Pretty New Wrapper

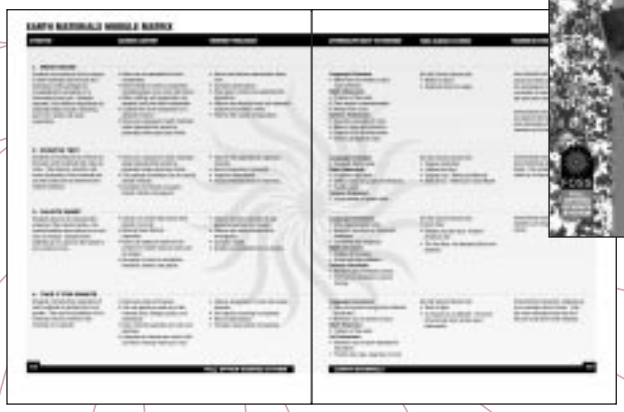
The teacher guide is our link to the classroom. Our conduit is the teacher. It is through the philosophical discussions and suggested pedagogical procedures that we hope to provide teachers with a *vision* of a high-quality science program for children, and the means for them to guide the experiences that *result in* a high quality science program. We've tried to walk that narrow line between providing a guide that is comprehensive (everything you ever wanted to know...) and one that is efficient and a joy to use.

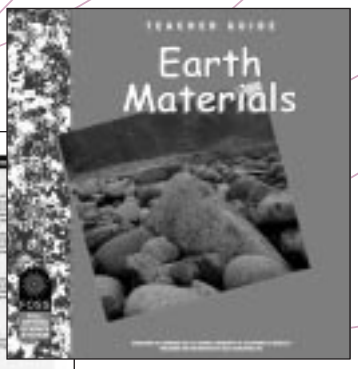
The new teacher guide has these features:

- New FOSS Introduction that presents the program as a complete science curriculum.
- Module overview folio, including a correlation with national standards (remember, there were no national standards when FOSS was developed ten years ago), scientific background, a suggested teaching schedule, and a spreadsheet-style planning guide for the entire module.
- A new Materials folio that describes all the materials and discusses a number of materials issues that pertain specifically to that module.
- New investigation folios. (These used to be activity folios, but we think the word *investigation* represents more accurately what a folio is all about.) The investigation folio now includes, in addition to the familiar step-by-step teaching suggestion, a graphic planning guide for the investigation, part-by-part, called At-a-Glance; a materials and preparation section for each part of the investigation; icons in the sidebars to indicate good times to use formative assessments, suggested times to read *FOSS Science Stories*, small-group discussions, break points in an investigation part, and safety alerts; and suggestions for "Wrapping Up" the investigation part. Each investigation folio also includes extensions in the areas of science, language arts, social studies, math (including a new idea called the Math Problem of the Week), and home and school extensions.
- Reformatted student sheets, including a Letter Home to Parents, a cover for a student journal (for grades 5–6), a student project planner, Math Problem of the Week sheet, and Home/School Connection sheet. All of the students sheets are provided in English and Spanish.
- Assessment folio providing guidance to the teacher for administering, scoring, and interpreting the suggested formative and summative assessments.
- Assessment duplication masters in English and Spanish.
- *FOSS Science Stories* folio offering suggestions for when to use each story (there may be as many as a dozen separate stories or articles in a science stories book), and a set of questions for engaging students in a discussion of the ideas presented in the reading.
- Resources folio with annotated listings of teacher and student reading and technology resources.
- FOSSweb folio that discusses the features of the website, the required computer setup to take full advantage of the features, and a few navigation tips.

The new design also features many new eye-catching graphics and photographs.





## Are My Students Learning? New Assessments Let You Keep a Finger on the Pulse of Learning in Your Classroom

We are living in a time of accountability. Everybody is looking for evidence that learning is progressing. It may be a trend or it may be the new educational order. At FOSS we accept the premise that student progress should be monitored and made available for thoughtful consideration. To this end we have invested a lot of thought and energy in reconceptualizing the assessment of FOSS and production of the assessment materials.

The rethinking of the assessment component started by identifying the overarching goals of the whole FOSS program. What do we expect students to learn and be able to do as a result of the FOSS experience? We arrived at three global domains of learning that characterize FOSS. In the vernacular of the assessment part of the program, these are our three assessment variables—the three areas of learning that we assess.

- Content knowledge
- Conducting investigations
- Building explanations

Content knowledge can be simple (the upper arm bone in humans is called the humerus) or complex (the greater the length of a pendulum arm, the fewer the cycles in a unit of time). Nonetheless, this is declarative knowledge and constitutes the facts, vocabulary, and principles that a person knows about the natural world.

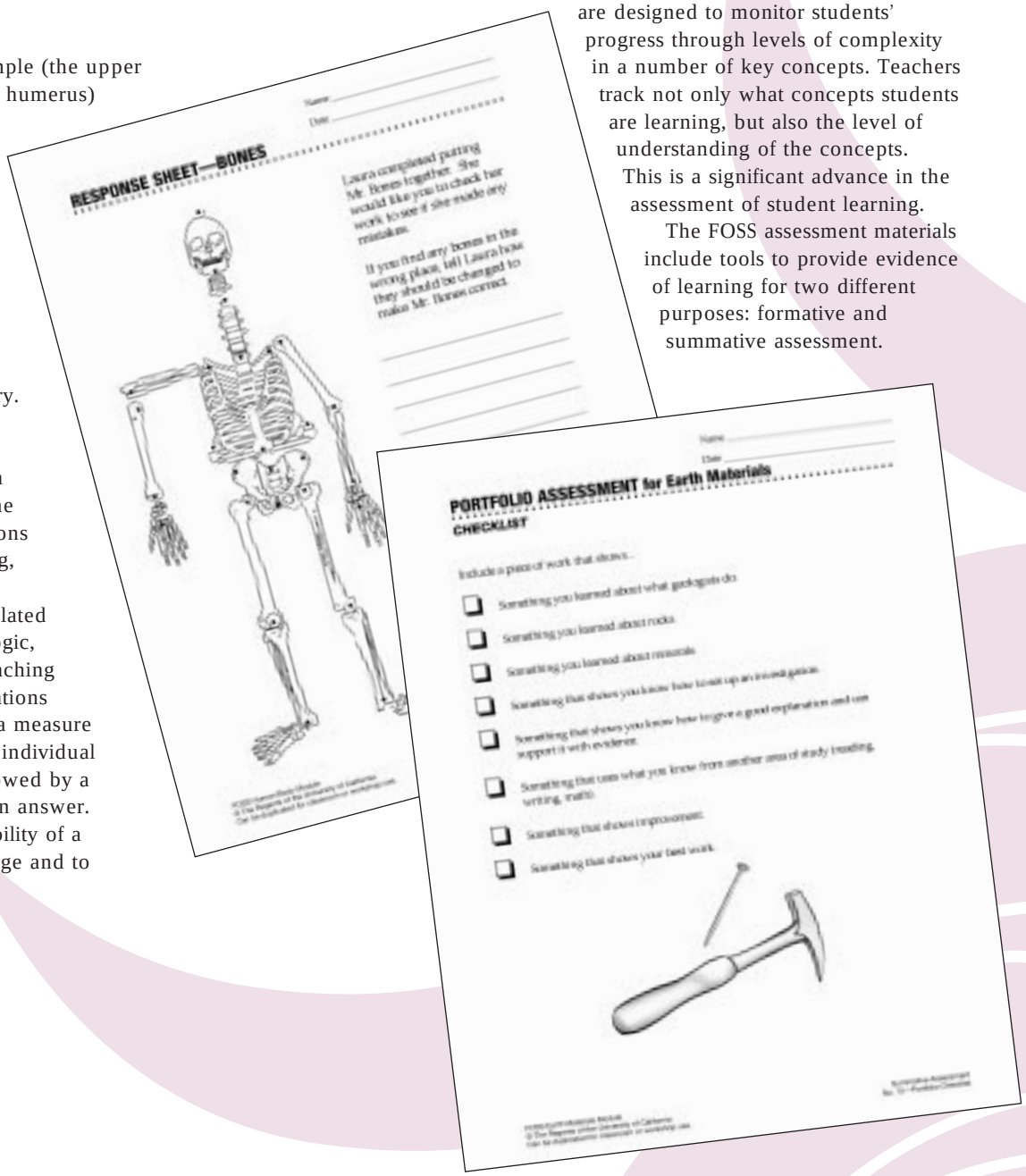
Conducting investigations is the measure of a person's ability to engage in the process of inquiry. The process of finding things out involves asking questions and proceeding to develop a plan for answering those questions. The variable of conducting investigations calls for a higher order of thinking, including observing, organizing, sequencing, relating, and other related cognitive interactions involving logic, evaluating, revising ideas, and reaching conclusions. Conducting investigations calls upon students to engage in a measure of divergent thinking, seeking an individual pathway through a problem, followed by a convergent thinking to arrive at an answer.

Building explanations is the ability of a person to construct new knowledge and to express it. Part of building explanations is the ability to explain what you know about the natural world, but more importantly, to explain how you know that it is true.

Another important dimension of building explanations is that most concepts have levels of understanding. For instance, the concept of electrical circuit may start with students explaining that electricity has to go in a circle or it won't work. This is true as far as it goes and an excellent explanation for students in third grade, but as more questions are raised about electrical circuits and more investigations are conducted, students will adopt increasingly complex explanations for circuits. These explanations might involve current flow, movement of charges, electromotive force, and perhaps eventually a model to explain the complex interactions of matter at the subatomic level.

The FOSS assessment materials are designed to monitor students' progress through levels of complexity in a number of key concepts. Teachers track not only what concepts students are learning, but also the level of understanding of the concepts. This is a significant advance in the assessment of student learning.

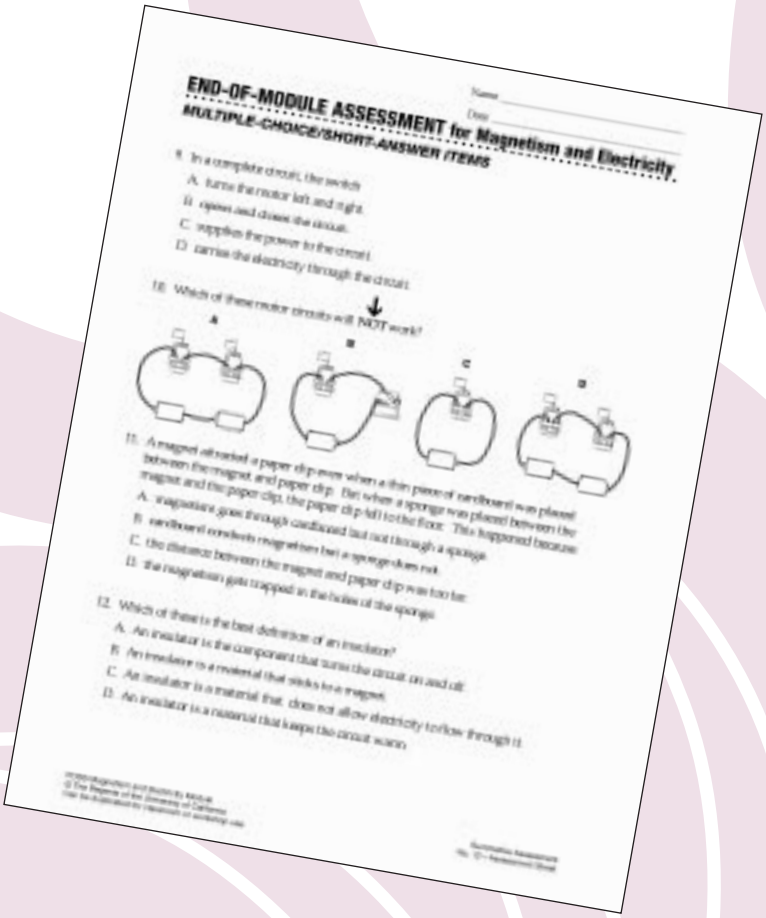
The FOSS assessment materials include tools to provide evidence of learning for two different purposes: formative and summative assessment.



Formative assessment is a teaching tool. Results of formative assessment should be limited to classroom use by students and teachers. Formative assessment provides a continuous stream of feedback on the effectiveness or instruction, allowing you, the teacher, to modify the direction and pace of instruction in response to immediate information on student knowledge.

Summative assessments are used at the conclusion of the module. These tools provide a snapshot of overall student achievement in the subject area, with information on student performance in each of the three assessment variable domains.

The assessment package includes the assessment strategies and tools (teacher observation, response sheets, students sheets, and performance assessments), scoring guides for each of the assessments, and record keeping tools. Tools to help in the preparation of end-of-the-module student projects and portfolios are also a part of the FOSS assessment system.


END-OF-MODULE ASSESSMENT for Magnetism and Electricity

MULTIPLE-CHOICE/SHORT-ANSWER ITEMS

## Materials Kits—The FOSS Kit Just Got a Little Better

The easily recognized black-and-white camouflage equipment kit has always been an important part of the FOSS success story. We took the occasion of the revision to review every item in each of the 16 kits. In a number of instances the quality of an item was upgraded. In other cases the quantity of equipment increased. And in a number of modules new items were added.

For instance, the Physics of Sound Module now has an electronic tone generator to replace the cassette tape of sounds of various pitches. The Human Body Module has some plastic bone replicas for students to work with. The circuit base and other plastic components used in the Magnetism and Electricity Module are now injection molded for greater precision of manufacturing. Throughout the modules there has been fine tuning and adjustments to quantities, but in no instance did we modify or revise the kit to a degree that it was rendered obsolete.

Most of the features of the FOSS kits remain the same. The quantities are still based on classes of 32 students; the original kit comes with consumables for two class uses (as does each FOSS module refill kit). Living organisms used in the modules are the same with the addition of land snails to the Structures of Life Module and owl pellets (once living organisms) to the Human Body Module.

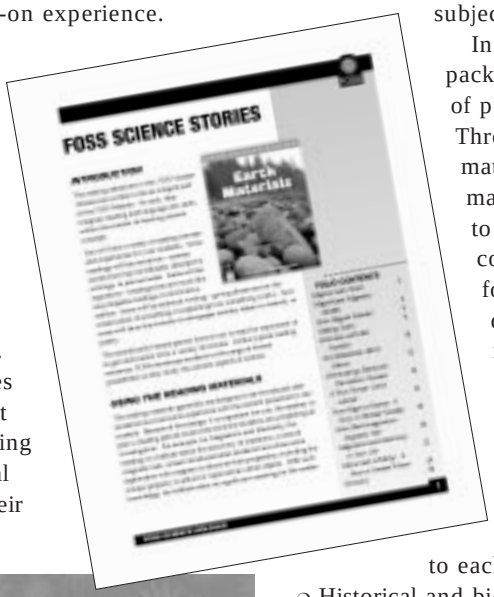
The changes you would notice if you compared an original kit with a revised kit side by side is the revised teacher guide—it is vastly improved, the teacher prep video is new and reflects the revisions made to the teacher guide, and the kit contains a package of eight *FOSS Science Stories* for that module. Otherwise, the kits look much the same as they did in the original edition.

You can upgrade your existing kits to revised program status by purchasing a teacher conversion kit (teacher guide, teacher prep video, eight *FOSS Science Stories*, and a safety poster) and an Equipment Conversion Kit to make the student materials compatible with the revised teacher guide.

## *FOSS Science Stories*
To Read or Not to Read?

To read or not to read … is an important question. Ten years ago we set out to develop a complete curriculum that would not be text dependent. We decided not to produce reading materials as part of the program. We believed that reading was important but that what one learned from reading would be enhanced if it came after hands-on experience. Reading is richer and has more meaning when students bring to the written word knowledge and enthusiasm developed through first-hand experiences. We wanted students to learn science by doing science, then enter into library resources to extend what they learned through printed materials.

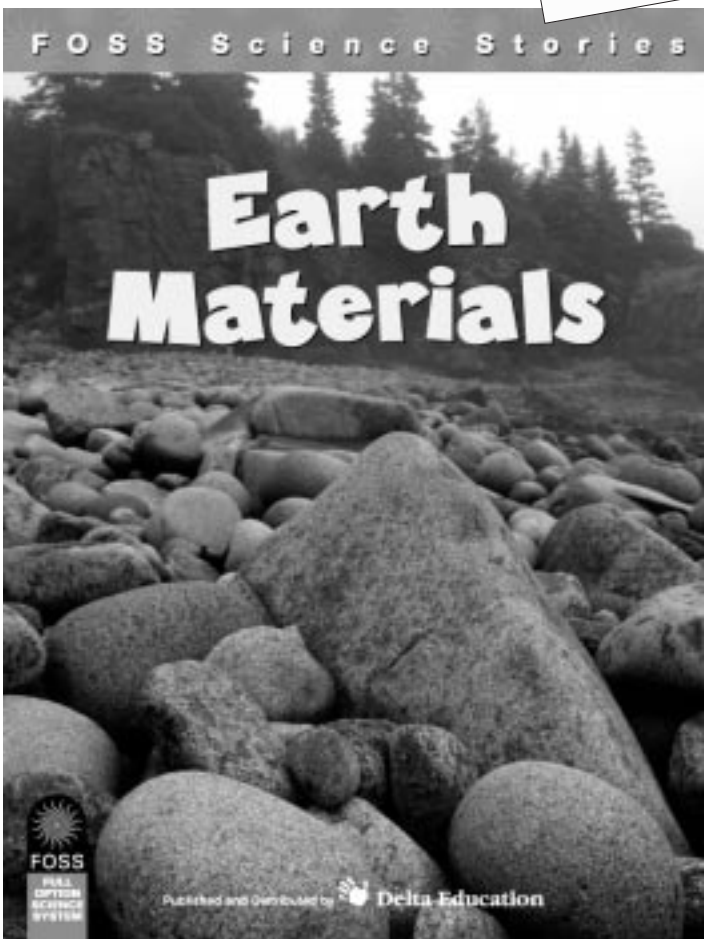
We know that reading can and should be incorporated into the science program. Reading enriches and extends the activities with objects, organisms, and materials that can't be brought into the classroom. Reading brings students in touch with the historical discoveries that laid the foundation for their own investigations. Reading allows students to share the adventures of others grappling with or using the science principles they have been working with in the classroom. Reading provides technical information for trying to build equipment or conduct investigations to continue their inquiry into the subject at hand.




In the "classic" version of FOSS we provided packages of books gathered together from a variety of publishers to supplement each FOSS module. Through our search for appropriate reading materials we found that there were few reading materials that met our tough standards. Books to supplement FOSS needed to include accurate content and be developmentally appropriate for students using FOSS. So we decided to develop our own unique set of reading materials, *FOSS Science Stories*.

Each revised FOSS module has a *FOSS Science Stories* book written specifically for that module. The materials are incorporated into our revised science program. The full-color books might have eight to twelve individual stories or articles that correlate to each module. The stories include:

- Historical and biographical readings.
- Fictional tales, myths, and stories about kids doing interesting things with science principles in an interesting context.
- Expository reading to add detail and extension to the knowledge gained from direct experience.
- Technical readings in which students follow instructions or follow technical explanations of scientific principles.



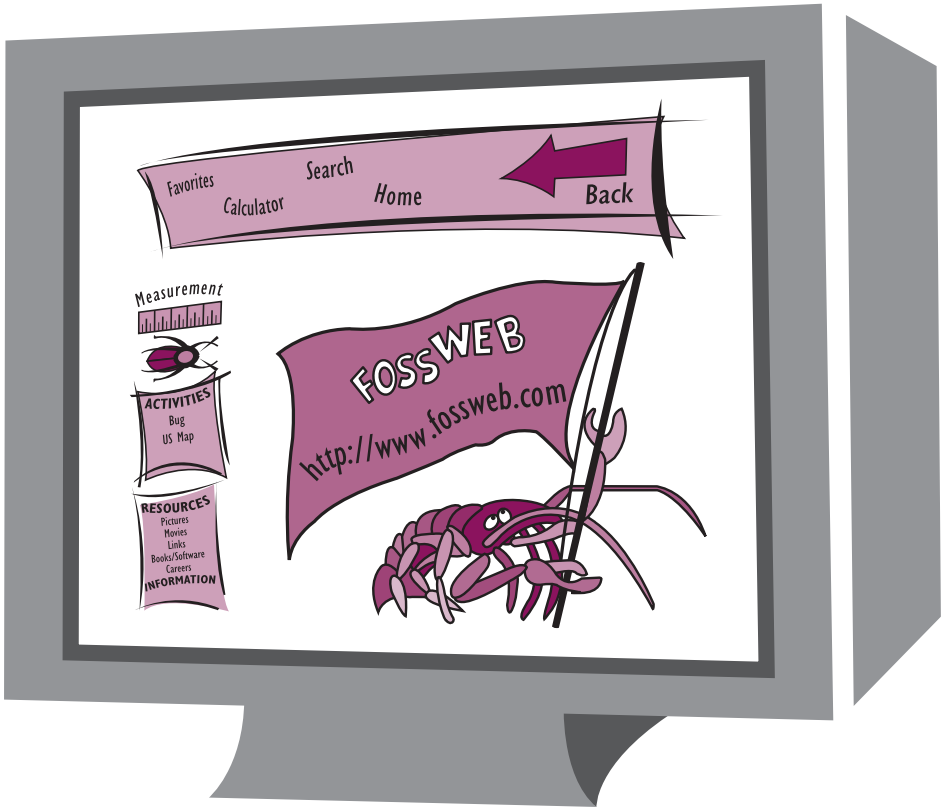

A *Science Stories* folio is included in the teacher guide to help you relate the *Science Stories* investigations. The *Science Stories* can be coordinated seamlessly with original FOSS as well. Your FOSS representative can answer any questions you might have. *Science Stories* books are available, in packages of eight, as line items. You can join the reading and literacy movement now by incorporating a reading dimension into your FOSS science curriculum.

## www.fossweb.com
## FOSS Goes High Tech

The FOSS program has entered the information age with an interactive, multimedia website. FOSSweb extends the walls of your classroom to the very limits of the World Wide Web. With FOSSweb you can communicate with other students and teachers using FOSS, write questions to a scientist, share classroom projects, and bring extraordinary resources into the classroom. Students can further their science investigations and exercise new skills and knowledge by using the interactive simulations designed for each FOSS module for grades 3–6. And students can bring FOSS into their homes and share experiences with their families.

FOSSweb provides a mechanism for constant updates and new resources for teachers and students and provides the opportunity for all FOSS users to contribute to the collection of those resources. All of the submissions to the website are moderated so they are appropriate and relevant to each module.

The website will be featured in future editions of this newsletter. If you want to connect, here's what you will need:




### Minimum Requirements for Using FOSSweb

*Macintosh Minimum Requirements*

- Power Macintosh with 24 MB RAM (32 MB or more recommended)
- System 7.6.1 or higher
- 16-bit (thousands) color minimum (8 bit will limit some graphic displays)
- Monitor resolution of 800x600
- Browser: either Netscape Communicator/Navigator, version 4.0 or higher or Internet Explorer, version 4.0.1 or 5.0 or higher. (Version 4.5 is not supported on Macintosh.)

*PC Minimum Requirements*

- Pentium or 5x86 120-MHz or equivalent with 24 MB of RAM (32 MB recommended)
- Windows 95
- 16-bit color video card and monitor (8 bit will limit some graphic displays)
- Monitor 800x600 resolution
- Browser: either Netscape Communicator/Navigator, version 4.0 or higher or Internet Explorer, version 5.0 or higher.

# If it Ain't Broke: The "Why" Behind the FOSS Revisions

by Professor Lawrence Lowery

Much of FOSS's success can be attributed to forward-looking educators who support a curriculum that emphasizes rigorous science standards while at the same time engaging students in motivating, interesting, investigative experiences. FOSS was based on the premise that teaching content only was never enough: True learning rests on the transfer of learning, the retention of concepts, and a sense of achievement on the part of learners.

Embedded in FOSS is some of the best research information on how people learn. The sequencing of investigations reflects the findings that conceptual knowledge is progressive and cumulative over time. No one ever learns the laws of physics, the workings of biology, or the grand ideas of chemistry in one course. Advanced concepts are learned through years of experience by building upon prior knowledge. Similarly, the ordering of experiences within FOSS investigations reflects the findings that knowledge is retained better through the exploration of concepts from various perspectives, taking more time to study, reflect, and discuss what is being learned. These applications of research have been verified through extensive testing of FOSS in many classrooms. And through these applications of research in FOSS, many educators have expressed that they have become more expert at what they understand and do in classrooms.

The proof that FOSS works can be seen in students' behaviors, teachers' comments, and some regularly reported student gains. FOSS has received hundreds of anecdotal success stories. Most praise the high quality of what is learned and the positive attitudes students develop toward science. Many success stories are from teachers who have rediscovered the joys of teaching through the FOSS pedagogy. Some are from students—boys and girls—who comment on their favorite FOSS experiences or send pictures and journal notes about what they have studied. Large urban school districts such as Los Angeles and Fresno have collected test data that indicate test scores have improved significantly since the implementation of FOSS.

We are pleased with the reputation the FOSS program has earned. In the words of one teacher, "FOSS brought joy back to teaching and quality science learning back into the classroom."

Because so much of the FOSS success is founded on applications of research and the field-testing of the product, one might question the rationale for revising the curriculum. Why make adjustments to something that's already working so effectively? Or, to rephrase the old adage, "If it ain't broke, why fix it?" It's a very reasonable question, and it has several answers.

The first is that the times have changed. In the past nine years since FOSS entered the marketplace, technology has become more prevalent in schools. Ways to assess thinking have improved. Knowledge about learning has increased.

The second reason is that FOSS developers are continual learners, and every year new research information—especially from the fields of cognitive science, brain physiology, and developmental psychology—suggests ways to improve curricula and teaching. And information from users of the program suggests ways to improve.

Without affecting the integrity of the original program, the thorough reworking of FOSS allowed us to embed new knowledge and experiences. As good as the original program was, it's now even better—more precise, more clearly expressed, more broadly based, and (most important of all) more flexible and useful.

1. FOSS was in schools before the National Science Education Standards were developed and published. It is not surprising that FOSS matched the standards very well, especially in the areas of content knowledge and inquiry. But a few "new" standards concerning careers and the history of science appear in the NSES. FOSS has been revised to meet most of the NSES that it did not include in its original version.

2. In the original FOSS, assessments were put into a separate folio and placed at the end of a module. It was expected that teachers would draw from the set of hands-on, pictorial, and narrative assessments to determine student progress. We found, however, that teachers tend to not use the assessments until the end of the instruction, so the assessments were being used as summative exams. Because the FOSS assessments are designed to inform teachers of student progress (not as final tests), the assessments are now embedded within the investigations so that teachers will know if more time and experience are needed for students to understand what is being taught. And they will learn which students need special assistance. The revised assessments are both formative and summative. They are accompanied by more detailed scoring guides, student examples, and suggestions for what to do with the results. Although all assessments are designed to inform teachers so that they will know what to do next, FOSS also suggests ideas to consider if grades are to be reported.

3. The questioning strategies in the original FOSS gave powerful suggestions for engaging students in thinking about aspects of each investigation. Some questions were narrow and integrating; some were broad and open-ended. Many teachers have become quite expert in using the FOSS questioning strategies and have found them useful across all areas of instruction. In the revised curriculum, the questioning strategies are woven into the teacher guide, and teachers are encouraged to engage students in thoughtful discourse. Discourse is a term we use to describe student-student and teacher-student verbal interactions that are so important to understanding. Research suggests that such discourse, when guided by appropriate questions, helps learners connect ideas with prior experiences and relates ideas that might have been experienced separately. Connected ideas are remembered better than unconnected ideas.

4. FOSS has always involved students in reading and other language arts experiences related to the science investigations. The curriculum encourages going beyond hands-on experiences to include simulations and reading resources. In the original curriculum, trade books and library references were listed or made available to extend student understanding toward abstractions. Research shows that understanding what one reads is improved if preceded by appropriate experiences. Bringing some knowledge to reading increases one's understanding of the reading. After much investigation into reading materials, FOSS staff came to the conclusion that quality books—books that contain appropriate and accurate content, developmentally appropriate content, and appropriate reading levels—were few and far between, and those that were well done usually went out of print before we could prepare a list of them. Thus a set of readers called *Science Stories* was developed. Unlike other reading materials, these are written to build upon and extend classroom experiences. In use, they are a seamless part of the science

*Continued on page 10*

instruction. The *Science Stories* were written to integrate: a range of types of writing—expository, narrative, and technical; a range of types of literature—fictitious stories, newspaper articles, step-by-step directions, and encyclopedic references; and a range of writing genres—histories, biographies, poetry, and folk tales. Very rich language arts experiences not available elsewhere are deeply woven into the fabric of the curriculum.

5. When FOSS was first written, computers were not common in elementary schools and websites were practically unknown. FOSS now provides, for grades 3–6, a website (www.fossweb.com) that allows students and teachers to communicate from school to school, share data on common projects, exchange ideas, and take students beyond the walls of the classroom. For schools without connections to the Internet, an interactive CD-ROM version that includes simulations will be available. As with the *Science Stories*, the CD can be used closely with the hands-on investigations.

6. There are many other features that improve FOSS—some additional activities, some improved equipment, new teacher preparation videos with more classroom examples, more back-ground on science for teachers, more information on student misconceptions, vignettes of classroom interactions, take-home extensions, math-related problems, and more.

As American companies move into the next millennium and are challenged by ever fiercer global competition, schools need to graduate well-prepared students from high schools and colleges for a world that is becoming more scientific and technology oriented. Elementary experiences set the foundation for later learning, thus the time is now for a "re-engineered" version of the FOSS curriculum classic. We offer it with confidence and enthusiasm to new generations of teachers and students and also, with thanks, to the people in the FOSS family—the thoughtful professionals and colleagues we are proud to call our friends who have used and helped make FOSS a successful curriculum.

## Online Connections for FOSS Modules

This issue of the FOSS newsletter focuses on surfing the topic of earth science. Check out www.fossweb.com for more web updates!

Building Stones of our Nation's Capital
*http://pubs.usgs.gov/gip/stones/*

This online booklet describes the source and appearance of many of the stones used in building Washington, D.C. The buildings have been constructed with rocks from quarries throughout the United States and many distant lands. Each building shows important features of various stones and the geologic environment in which they were formed. (Earth Materials Module)

Career Profiles: Association of Women Geoscientists
*http://www.awg.org/cp/cp.html*

This site from the Association of Women Geoscientists includes career information plus profiles of many women who have made geoscience a career. (Earth Science Strand)

Careers in the Geosciences
*http://www.agiweb.org/career/brochure/career97.html*

The American Geological Institute has included an online version of their pamphlet concerning earth science careers. It also includes addresses to connect with for more information. (Earth Science Strand)

Color Landform Atlas of the United States
*http://fermi.jhuapl.edu/states/states.html*

This site includes a number of downloadable relief maps and satellite images for each state. (Landforms Module)

Geology Image Search
*http://www.science.ubc.ca/~eoswr/cgi-bin/db_gallery/search.html*

The University of British Columbia (UBC) EOS Image Gallery allows you to search and download images from their collection related to the earth and ocean sciences. (Earth Materials and Landforms Modules)

Make a Stereoscope
*http://www.usgs.gov/education/learnweb/MpLesson4Act1.html*

This site on USGS's Learning Web gives directions for making a device to view stereo pairs of aerial photographs. With the device you can view landforms in 3D! (Landforms Module)

NASA Observatorium: The Sun
*http://observe.ivv.nasa.gov/nasa/exhibits/sun/sun_1.html*

NASA presents information about the sun, what we know about it, and what people used to think about it. (Solar Energy Module)

Mechanical Weathering of Rocks
*http://skhtkpss.school.net.hk/geog/landform/weathering/physical.htm*

This site from Hong Kong includes some nice images and animations showing how rocks disintegrate. Check out the animation that shows water freezing in a crack and wedging the rock apart as it expands. (Landforms Module)

SunBlock '99
*http://www.sunblock99.org.uk/*

SunBlock '99 is a multi-media tour of the sun. Young scientists from the United Kingdom (our Solar Guides) take you on a journey to one of the most fascinating places in our solar system. The site includes Solar Fact Files, animations, a picture gallery, links, and tips for teachers. (Solar Energy Module)

TerraWeb for Kids
*http://TerraWeb.wr.usgs.gov/TRS/kids/*

The U.S. Geological Survey in Flagstaff, AZ, has compiled this set of images, activities, and interactions dealing with remote sensing and image processing. (Landforms Module)

Water Cycle: Follow a Drip
*http://wwwga.usgs.gov/edu/followdrip.html*

Follow a drip through text and graphs as it travels around the water cycle on the USGS Water Science for Schools web pages. (Water Module)

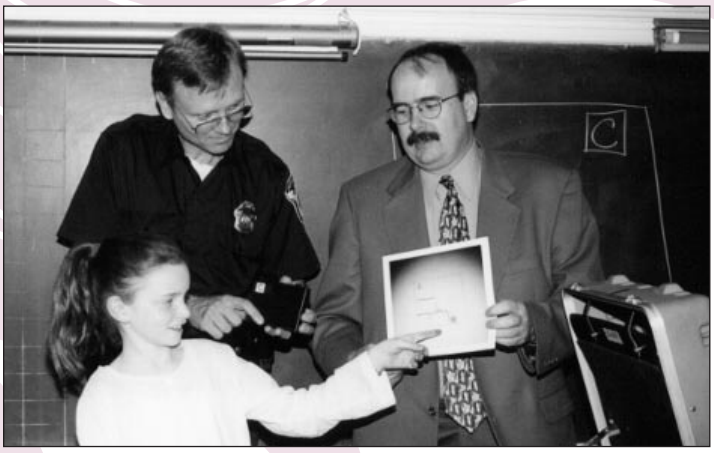
# What a Blast!

By Dr. Elizabeth D. Holley

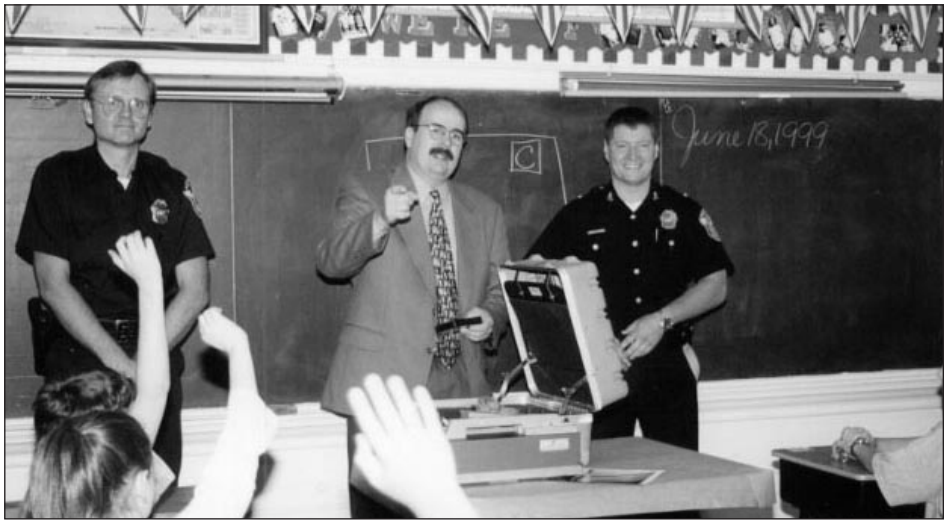
In science, as in other curricular areas, teachers strive to provide students with opportunities to practice their skills in ways that simulate authentic or real-life situations. In the FOSS Models and Designs Module, the *Black Box* investigation should be no exception. In this investigation, teachers are encouraged to group students into research teams that cooperatively attempt to identify a black box's internal components and their configuration. These research teams report to others in a mock conference where they share ideas, problems, and possible solutions. Teachers point out similarities and differences between this process and the one used by real scientists. These real-life, authentic comparisons can be both strengthened and highlighted in an activity designed and undertaken by Dr. Elizabeth D. Holley of the Willard School in Ridgewood, New Jersey.

With the close of the *Black Box* investigation drawing near, a teacher-led discussion of black boxes in real life was held. The question, "If a real black box were found, how could someone determine what was in it?" was posed.

Quite by coincidence, a local police detective stopped by for a visit and was drawn into the lesson. Students posed questions to the detective who explained the proper police procedure for dealing with a black box or any suspicious package with unknown contents. He asked the students what strategies they had already utilized and what tests they had undertaken. He compared their procedures to his and helped them see why police react in the manner in which they do.



Caroline Logue points out the internal configuration of a black box in an x-ray taken by members of the Bergen County Police Department's Bomb Squad.




Members of the Bergen County Police Department's Bomb Squad answer questions about real-life black boxes posed by the fourth-grade students of Dr. Elizabeth Holley.

From a quick inspection of a black box, the officer was unable to determine its contents and layout. The students asked him what he, as a detective, would do next if the black box were truly suspicious. He calmly answered, "I'd call the Bergen County Police Bomb Squad." The students' enthusiastic response was "Let's do it!"

The Bergen County Police Bomb Squad was subsequently contacted, and a class visit was scheduled. The long-awaited day came. The squad members arrived at Willard School toting the equipment they would use had they been responding to a call regarding a suspicious black box. Again students were given the opportunity to explain their investigation of the black box. Then individual members of the bomb squad met with the student research teams and critiqued their lab reports. The officers explained their training, procedures, and related tales of past cases.

The officers decided that, in the case of the suspicious black box, an x-ray would have been taken to provide them with more information. Every student begged them to x-ray the box. They watched anxiously as the x-ray was developed in the portable developer.

The level of suspense increased when the first x-ray proved to be too powerful to accurately see inside the black box. A second x-ray was taken successfully. Amid astonished gasps, the officers examined the x-ray and pronounced the contents to be "a marble and corrugated paper held together with masking tape." They went on to explain the configuration of the paper within the box. Students marveled at the officers' expertise and continued to ask appropriate science-based questions concerning the equipment capability and the officers' ability to read x-rays.

Although the teacher's primary purpose in inviting the officers to the classroom was to provide a reality-based science experience, other very important lessons were learned. The students developed a real bond with the officers and became concerned for their welfare while on the job. They also developed a heightened awareness and appreciation for the training and everyday work of law enforcement officers.

*Submitted by:*
***Dr. Elizabeth D. Holley***
*Willard School*
*601 Morningside Road*
*Ridgewood, NJ 07450*
*201-670-2770*

## Who ARE These People and WHAT Are They Doing? Ten Years of Doing FOSS!

Recognize anyone? What they are up to? The photo collage on these two pages includes just some of the many people who have contributed to the success of FOSS over the past ten years. Some have participated in development, others in training, and others in implementing FOSS in their classrooms. To all, whether captured in these photos or not, many, many thanks!


**1.** Teachers at a FOSS institute tackle the concentration puzzle from the **Mixtures and Solutions Module**. **2.** Linda De Lucchi, Sue Jagoda, and Susie Collins consult on an activity being developed at Pinole Middle School for the Middle School **Earth History** mini-course. **3.** Second-grade students explore the properties of solids and liquids in the **Solids and Liquids Module. 4.** Students investigate series circuits in the **Magnetism and Electricity Module**. **5.** Larry Lowery works through some aspects of learning theory during a FOSS workshop. **6.** Larry Malone and Kathy Long engage in crayfish wars during local trials training for the **Structures of Life Module. 7.** Larry Malone challenges a group of students in Oakland during the development of the **Levers and Pulleys Module**. **8.** Arthur Camins and Sheila Dunston try out an investigation from the **Wood Module**.


**9.** Comer Johnson and Dean Taylor tackle the *Humdinger* activity from **Models and Designs** as Verne Isbell and Ed Rupp engage in background conversation. **10.** Students come up with a better idea for the **Balance and Motion Module**. Put handles on your zoomers! **11.** Students investigate the variables that affect lifeboat capacity in the **Variables Module**. **12.** Teachers in Bratislava try out an activity from the **Magnetism and Electricity Module**. **13.** Linda and Larry prepare materials for an investigation during the development of the **Environments Module**. **14.** Geologic investigations require close, careful observations as these students have learned in the **Earth Materials Module**. **15.** The stream table from the **Landforms Module** captures the attention of these Oakland teachers.

## New from the Wordsmiths

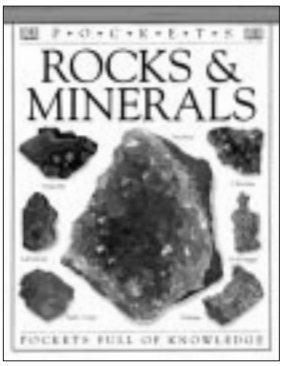
We're focusing on the FOSS Earth Science strand in this issue of the newsletter. The books annotated here are just some of the new discoveries we made during the revision of the grade 3–6 FOSS modules. For a more complete listing, check the Resource lists in the new teacher guides or the FOSS website at http://www.fossweb.com.

### STUDENT READING
### Nonfiction

Earth Materials Module

**From Sea to Salt**
By Ali Mitgutsch. Carolrhoda Books (A Start to Finish Book), Minneapolis, 1985. ISBN 0876142323. Grades K–4.

Explains concepts of evaporation and brine and discusses how salt is obtained from desalinization process.



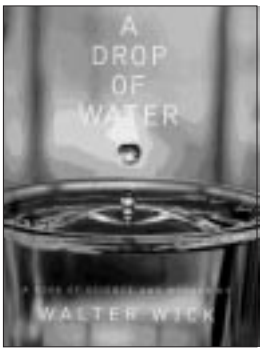

**Rocks and Minerals (Pockets)**
By Sue Fuller. Dorling Kindersley Ltd. (A DK Pocket), London, 1995. ISBN 1-56458-663-4. Grades 4 and up.

A pocket-sized reference guide for identification of rocks and minerals. Includes color photographs.

Water Module

**A Drop of Water**
By Walter Wick. Scholastic Press, New York, 1997. ISBN 0-590-22197-3. Grades K–3.

Introduces the properties of water through words, color photographs, and simple investigations. Includes discussions of evaporation, condensation, capillary attraction, and surface tension.




**Great Experiments with $H_2O$**
By Noel Fiarotta and Phyllis Fiarotta. Sterling Publishing, New York, 1997. ISBN 0-806-94249-5. Grades 4–8.

A series of activities organized by water's forms and properties, including surface tension, cohesion, temperature, and capillarity.

**Water: Simple Experiments for Young Scientists**
By Larry White. The Millbrook Press, Brookfield, CT, 1995. Illustrated by Laurie Hamilton. ISBN 0-761-30090-2. Grades K–3.

Includes projects that focus on water and its properties, including turning salt water into fresh water, making waves in a bottle, and building a bird's-eye view of rain.

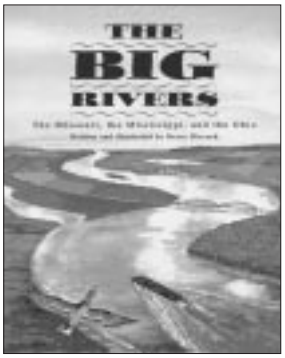
Water Up, Water Down: The Hydrologic Cycle
By Sally M. Walker. Carolrhoda Books, (A Carolrhoda Earth Watch Book), Minneapolis, 1992. ISBN 0-876-14695-7. Grades 4–8.

Describes the hydrologic cycle and its importance to life on Earth. Color photographs and illustrations.

Water, Water Everywhere
By Mark J. Rauzon and Cynthia Overbeck Bix. Sierra Club Books for Children, San Francisco, 1994. ISBN 0-871-56598-6. Grades K–3.

Describes the forms water takes, how it has shaped Earth, and its importance to life on Earth. Color photographs.

Landforms Module




The Big Rivers: The Missouri, the Mississippi, and the Ohio
By Bruce Hiscock. Atheneum Books for Young Readers, New York, 1997. ISBN 0689808712. Grades 3–6.

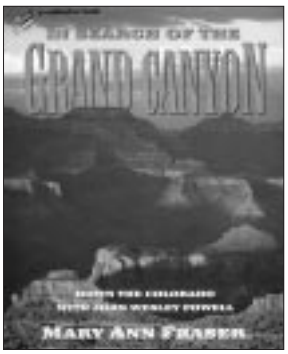
Describes the conditions that led up to severe flooding in the Mississippi River valley in 1993.

Hoover Dam
By Craig A. Doherty and Katherine M. Doherty. Blackbirch Press, Woodbridge, CT, 1995. ISBN 1567111076. Grades 4–8.

Describes the history of Hoover Dam, the first major dam to harness the waters of the Colorado River.

In Search of the Grand Canyon: Down the Colorado with John Wesley Powell
By Mary Ann Fraser. Henry Holt and Company (A Redfeather Book), New York, 1995. ISBN 0805034951. Grades 4–8.

This account tracks Powell's 1869 expedition day by day as the party passes through the rapids, whirlpools, and canyons along the river.



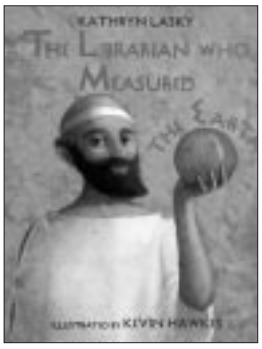

Rivers
By Jane Parker and Steve Parker. Franklin Watts, Danbury, CT, 1997. ISBN 0531144585. Grades 3–6.

An overview of the rich and varied environments of Earth's rivers. Describes five of the most famous rivers in the world.

Solar Energy Module

Amazing Sun Fun Activities
By Michael Daley. Learning Triangle Press/McGraw-Hill, New York, 1998. Illustrated by Buckley Smith. ISBN 0070151776. Grades 3–8.

Includes solar experiments and projects that use ordinary household "junk" and fast-food containers. Students can build a working solar oven and a solar water heater, and design solar-powered homes.




The Librarian who Measured the Earth
By Kathryn Lasky. Little, Brown and Company, New York, 1994. Illustrated by Kevin Hawkes. ISBN 0316515264. Grades 5–8.

Over 2000 years ago, a boy named Eratosthenes was known for always asking questions. As an adult he became the head of the great library of Alexandria. This is the story of how he used the sun to accurately measure the circumference of Earth. A beautiful combination of history, mathematics, science, and biography.

Shadow Play: Making Pictures with Light and Lenses
By Bernie Zubrowski and the Children's Museum of Boston. William Morrow and Company, New York, 1995. ISBN 0688132103. Grades 5–7.

Inviting inquiry-based projects. Instructions are given for making a box camera and shadow box to use for exploring light.

The Sun
By Paulette Bourgeois. Kids Can Press (Starting with Space), Buffalo, NY, 1997. ISBN 1550741586. Grades 5–7.

Facts, stories, hands-on experiments, and illustrations combine to explain basic concepts about the sun, the movement of Earth, the sun's light, and using solar energy.

## STUDENT READING
## Fiction

Water Module

Drylongso
By Virginia Hamilton. Harcourt Brace, New York, 1997. Illustrated by Jerry Pinkney. ISBN 0-152-01587-6. Grades 4–8.

An African American story about Lindy and her family, who are suffering through a long drought. The mystical boy, Drylongso, teaches them the secrets of finding water hidden in the Earth.

Water Dance
By Thomas Locker. Harcourt Brace and Company, San Diego, 1997. ISBN 0-152-01284-2. Grades K–3.

A poem describes the many forms water takes, including storm clouds, mist, rainbows, and rivers. Color illustrations. Also includes factual information about the water cycle.

Landforms Module

Mighty Mountains: The Facts and the Fables
By Finn Bevan. Franklin Watts/Grolier Company, Danbury, CT, 1997. Illustrated by Diana Mayo. ISBN 0516262998. Grades 3–6.

Describes some of the world's best-known mountains, including Mount Olympus, Mount Ararat, and Mount Fuji, and the stories connected with them.

Ming Lo Moves the Mountain
By Arnold Lobel. William Morrow and Company, New York, 1986. ISBN 0688109950. Grades 3–5.

*Continued on page 16*


A funny tale about a couple who live in the shadow of a mountain and their efforts to move it so their crops will get more sun to grow.

## TEACHER RESOURCES

### Resources from the U.S. Geological Survey

You can obtain a variety of resources from the USGS, including maps, aerial photos, posters, and topographic maps. Call them at 800-HELP-MAP.

You can also contact your regional Earth Science Information Center. Call the number above to find the location nearest you or browse the Internet at *http://mapping.usgs.gov/esic/esic_index.html*. Some specific resource information follows.

### Landforms of the Conterminous United States: A Digital Shaded-Relief Portrayal (map)

Miscellaneous Investigations Series Map, I-2206.

This black-and-white map of the lower 48 states of the United States is a digitally enhanced, shaded relief map showing many of the significant landforms and physiographic provinces. You can download more information and a digitized version from *http://www.usgs.gov/reports/misc/Misc._Investigations_Series_Maps_(I_Series)/I_2206/I_2206.html.*

### USGS Topographic Maps

The USGS sells nearly 70,000 topographic map titles. Find maps for your area by browsing the following website: *http://mapping.usgs.gov/mac/findmaps.html*.

### Hot Water and Warm Homes from Sunlight

Great Explorations in Math and Science (GEMS), Lawrence Hall of Science, University of California, Berkeley, 1997. Grades 4–8.

This guide includes details for student experiments with model houses and water heating to discover more about solar power. Students learn what a controlled experiment is and conduct experiments to determine the effects of size, color, and number of windows on the amount of heat produced from sunlight. There is a section on the greenhouse effect and on solar ovens in the recent editions of this teacher guide.

## FOSS at the Grand Canyon

The Grand Canyon is the focus of two modules in the FOSS Earth Science strand. In the **Landforms Module**, students set up a model of the Colorado Plateau in a stream table and investigate the factors that might have caused the Grand Canyon to form. In the FOSS Middle School **Earth History** mini-course, students take a virtual visit to the Grand Canyon as they investigate and interpret its geologic history.

What better place is there to learn about these modules and study the Grand Canyon than at the Grand Canyon itself? In cooperation with the National Park Service team at Grand Canyon National Park, the FOSS staff is in the beginning stages of planning a teacher workshop that will take place at the South Rim of the Grand Canyon. The workshop would tentatively take place for five days during the last two weeks of June 2000. Besides hands-on training in the FOSS **Earth History** mini-course, NPS staff will give lectures on the geology and natural history of the Grand Canyon as well as lead hikes to view the canyon up close. Time would also be spent devising a plan to identify resources and "personalize" the FOSS **Earth History** mini-course to the participants' local areas.

Before firm plans are made, we'd like to find out what kind of interest there is among FOSS users for this experience. Accommodations (approximately $40 a night) will be available at Albright Training Center, or participants could plan to camp at a nearby campground. There will probably be a fee associated with the workshop to help cover other costs (up to $150 per person depending on enrollment). Participants will be responsible for their own travel to the Grand Canyon and for room and board costs. College credit may also be available if there is enough interest. Group size will be limited to 30 participants.

Interested? Please drop us a note via e-mail. (This is just a preliminary survey. Your correspondence does not commit you. We are trying to determine if there is enough interest to host such a workshop.)

***Sue Jagoda***
*skjagoda@uclink4.berkeley.edu*
*Lawrence Hall of Science*
*University of California*
*Berkeley, CA 94720*
*Phone: 510-642-8941*

For other information about education programs at the Grand Canyon, contact Jacob Fillion at 520-638-7762 or Jacob_Fillion@nps.gov.

# Software and Video Reviews

## SOFTWARE

Earth Materials Module

### *The Wonders of Rocks and Minerals*

CD-ROM for Windows and Macintosh
By Edward J. Tarbuck, Frederick K. Lutgens, and Edward Greaney, TASA Graphic Arts, Inc., 1997. Grades 4–8. Phone: 800-293-2725 or 505-293-2727.

Explores the world of geology. Answers questions such as what are minerals and how are they different from rocks? What are the three groups of rocks and the geological processes involved in the formation of each? You will learn to identify and name minerals and rocks, just like a geologist does on a field trip. Includes a mineral database of over 50 common minerals. For more information, check their website at *http://www.swcp.com/~tasa/.*

Water Module

### *Hydroexplorer Comes to Your Home*

Windows and Macintosh
Water Education Foundation, Sacramento, CA. Grades 3–5. Phone: 916-444-6240. *http://www.water-ed.org/.*

This game teaches about water conservation, pollution, the hydrologic cycle, and how water gets to the home. Players search for clues as they guide a minisub from a rain cloud through the maze of water pipes, through the treatment plant, and into a building.

### *Water Cycle*

CD-ROM for Macintosh and Windows
Tom Snyder Productions, Watertown, MA (Science Court). Grades 4–8. Phone: 800-342-0236. *http://www.tomsnyder.com/index.shtml.*

Students explore the water cycle with Channel 23's weatherwoman, Maria Hernandez, as the case of Mr. I. M. Richman who slipped and fell at the subway station is argued. This courtroom "drama" introduces the concepts of condensation, evaporation, water vapor, and the water cycle.

Landforms Module

### *A Topographic Field Trip of Washington, D.C.*

CD-ROM for Macintosh and Windows
U.S. Geological Survey, Information Services, Denver. Grades 5 to adult. Phone: 888-ASK-USGS.

This interactive field trip begins with a "landing at Washington National Airport." After exploring a topographic map of the area, students answer questions in a journal. Correct answers eventually earn a Metrorail farecard. This program covers a variety of topics concerning topographic maps, digital imaging, and orthophotos. A free version is available for Macintosh. A fact sheet about the program is available at *http://mapping.usgs.gov/mac/isb/pubs/factsheets/fs02598.html.*

Solar Energy Module

### *The Sun's Joules*

CD-ROM for Macintosh and Windows
Alliance to Save Energy and the Center for Renewable Energy and Sustainable Technology. CREST Software, Washington, DC, 1997. Grades 6 and up. Phone: 888-44CREST.

*Continued on page 18*

Reviews continued

A comprehensive educational CD-ROM on renewable energy. It contains about 1000 screens of text and graphics, dozens of digital videos, interactive exercises, an energy glossary, a list of renewable-energy Internet resources, and a detailed index. Includes the School Energy Doctor software, which walks students through an energy and water audit of their school facilities. An online version is available on Solstice at *http://solstice.crest.org/renewables/SJ.*

## VIDEOS

Water Module

### *Rain and Snow (Weather Fundamentals)*

Schlessinger Media. Wynnewood, PA. 23 minutes. Grades 4–8. Phone: 800-843-3620 or 610-645-4000. *http://www.libraryvideo.com/sm_home.asp*.

Spencer Christian, the Good Morning America weatherman, hosts this film that promotes an understanding of how rain and snow form. Beginning with a water molecule, explanations and illustrations for how various types of precipitation form are given as well as how the water cycle works. Includes teacher's guide.

### *The Water Cycle*

United Learning, Niles, IL. 11 minutes. Grades 3–8. Phone: 800-323-9084. *http://www.unitedlearning.com/agc_99/index.html.*

Explains the relative scarcity of fresh water and moves on to illustrations of the complete water cycle. Computer graphics help illustrate the concepts. Includes lesson plans, student activities, and duplication masters.

Landforms Module

### *Drops of Water, Grains of Sand*

United Learning, Niles, IL. 10 minutes. Grades 4–8. Phone: 800-323-9084. *http://www.unitedlearning.com/agc_99/index.html.*

Live-action video depicting the movement of water, beginning with the formation of rivers in mountains and the flow of the water toward the sea. Large stream tables used as simulation. Japanese landforms reinforce the ideas presented.

Solar Energy Module

### *Solar Energy*

By TMW Media Group (Science in Action), Venice, CA. 18 minutes. Grades 5–9. Phone: 800-262-8862. *http://www.tmwmedia.com/.*


Live action and graphics introduce three basic concepts of solar energy: how ancient and modern cultures have captured energy from the sun, how solar energy can be transferred, and how energy can be stored.

## Something New for the Insects Module? Vending Machine Beetles

Betty Buginas, a teacher at Castro School in El Cerrito, California, sent us an Associated Press article recently that described vending machines in Japan that distribute live bugs. Could this become a new way to acquire bugs for the FOSS **Insects Module**?

Collecting beetles is one of the most traditional summertime hobbies for Japanese children. As part of their summer fun, youngsters travel into local mountains to catch the prized beetles and other insects with nets. Some even turn a profit from their hobby. Rare insect species can sell for thousands of dollars in pet stores.

So an enterprising vending machine company, Mirai Seiko in Ogaki, 220 miles west of Tokyo, brought together technology and convenience to serve consumers. They converted a vegetable vending machine to sell insects. One machine can hold up to 100 stag beetles. Mirai Seiko went into the bug business when workers found they were encountering lots of beetles with the mushrooms the company harvests off trees during Japan's steamy, rainy summer. Instead of throwing away the insects, company directors thought they might as well make some money off them.

The beetles are fairly inexpensive at $3.35 a pair. Just like folks line up hours ahead of time to snatch the latest Beanie Baby issues, it is a mob scene at the Mirai Seiko store when new beetles go on sale. Typically, the beetles sell out in two or three hours. So there is no problem keeping the bugs alive in the vending machine.

GOT BUGS?

## FOSS Institutes

Delta Education will host 2-day Informational Institutes this academic year in conjunction with the NSTA Area and National Conventions. These Institutes are designed for all educators—lead teachers, administrators, curriculum coordinators, university methods instructors, science committee members, and school board members—who are interested in finding out what FOSS is, who developed it, what philosophy of education it supports, and to begin networking with other FOSS users. A lot of time at these Institutes is spent with the program materials, doing activities and engaging in inquiry.

During the summer Delta hosts Implementation/ Leadership Institutes. These meetings are designed for educators who have adopted FOSS and are into their implementation process. Some time will be spent working with the FOSS materials, but a greater proportion of time will be spent delving into issues of management, teacher preparation, materials maintenance, and a host of other subjects.

Most Institutes are led by FOSS development staff. There is no charge, but participants must register in advance to attend. Times and locations are listed in the calendar. To secure your spot at the Institute of your choice, call, write, or fax:

Pam Frisoni
Delta Education, Inc.
80 Northwest Boulevard
Nashua, NH 03063

Phone: 1.800.258.1302, ext. 503
Fax: 603.579.3504

### FOSS NSTA Pre-Convention Informational Institutes

#### NSTA DETROIT REGIONAL CONVENTION

October 19, 1999
Tuesday
What's new with FOSS 3-6
(an introduction to the 2000 Edition)

October 20, 1999
Wednesday
FOSS Middle School Introduction

#### NSTA TULSA REGIONAL CONVENTION

November 16-17, 1999
Tuesday-Wednesday
FOSS K-6 Introduction Workshop

#### NSTA RENO REGIONAL CONVENTION

November 30 & December 1, 1999
Tuesday-Wednesday
FOSS K-6 Introduction Workshop

❑ **Yes! I'm interested in attending a FOSS Informational Institute being held in conjunction with the**

_____ **NSTA Convention.**
(Location)

❑ **Yes! I'm interested in attending a FOSS Implementation/Leadership Institute being held during the summer.**

**Please send me registration information.**

Name _____

School _____ District _____

Title _____

Address _____

City _____ State _____ Zip _____ Daytime Phone _____ Fax _____

❑ I did **not** receive this FOSS newsletter in the mail. Please add my name to the mailing list.

## About This Newsletter . . .

The intent of the FOSS Newsletter is to help FOSS users develop a network of support across the country. Delta Education and LHS will work together to bring you news two times per year, including articles regarding the latest development of modules, tips about management from teachers and administrators, ways to make connections with other teachers and districts, extensions and reading materials to add to modules you are already using, and informative articles about good educational practices.

So, we need your help. If you have a tip that enhances the teaching of FOSS or would like to submit an article (with photos) about exciting activities or school programs, management, implementation projects, etc., please send them in. We would also like to hear from your students, whether they have questions about the content, projects they have done, photos or other images they have created, or insights into how they use the World Wide Web with FOSS. Send your contributions to:

*FOSS Newsletter*
Lawrence Hall of Science
University of California
Berkeley, CA 94720-5200

*The deadline for submissions to the next issue is January 10, 2000. We're waiting to hear from you.*

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