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FOSS™ NEWSLETTER

In this issue:

FOSS/Science Education Equity Project Ends . . . and Continues!

by Curt Jacquot

A National Science Foundation grant funded a FOSS-based science curriculum enhancement project that involved science methods educators, scientists, and elementary teachers. Professors from California State University, San Bernardino (CSUSB), worked in partnership with elementary teachers from Fontana Unified School District (FUSD). The three-and-a-half year project has ended, but the project activities will continue because the CSUSB science educators and scientists will continue to collaborate with the district teachers to enhance science education.

During the initial stages of the project, elementary teachers met weekly for a four-hour FOSS in-service seminar. Experienced FOSS teachers and CSUSB professors comprised the seminar leadership team. The seminars concentrated on three areas that led to enhancement of the FOSS curriculum.

- Content information presented by CSUSB professors Dr. Javier Torner (physics), Dr. Lisa Shamansky (chemistry), and

Continued on page 2

FOSS at Ridgway High School—A Joint Venture Program

by Charlotte Imboden

Recently Santa Rosa's elementary school district was able to adopt the FOSS program with a grant from Hewlett Packard. However, past experience with other kinds of science kits had taught the district that after consumable parts are used, kits are often left sitting on a shelf to gather dust.

> ***"This is great! And we don't just sit and get lectures."***
>
> Sophia Shaw,
> Ridgway Student

Not this time. It was decided that the district would maintain the kits. A portable building was moved to the district

Continued on page 2

Equity Project continued

Dr. Klaus Brasch (natural science).

- Science education methods, techniques, and teaching strategies presented by Dr. Joseph Jesunathadas and Dr. Iris Riggs in cooperation with experienced FOSS teachers.
- Techniques and methods for teaching English Language Learners presented by Dr. Esteban Diaz.

Teachers kept journals and developed portfolios that documented their experiences. The seminars were followed by school visits to observe FOSS in action. The close and supportive professional relationship that developed between many of the teachers and professors led to vows by both to continue acting as mutual resources after the project ended.

Life After Funding

A six month "extension" phase of the project had the FOSS-trained FUSD teachers and CSUSB professors teaming to design and implement FOSS enhancing projects for the school sites involved. The main goal of the extension was to increase the number of teachers using the FOSS materials.

After an initial needs assessment, site plans were developed for each of 15 participating schools. Most of the school plans included a site-specific method for managing the FOSS kits as the absence of such a plan had been identified as a barrier to FOSS use by many teachers.

Project Extension Produces FOSS TeacherTips

In a culminating group project, teachers and CSUSB faculty worked together to develop a FOSS TeacherTips booklet. The tips were defined as "kernels of teacher wisdom" that make a lesson work effectively and progress smoothly. Many of the tips are specific to FOSS use in the district and region. A lot of blank pages were built in so that new tips could be added as they emerged. Teachers were encouraged to add their own tips to further customize the booklet for their school, classroom, and teaching style.

A separate tips booklet was developed for each of the 16 FOSS modules that had been adopted by the district. Each booklet is organized into several different sections. Each section is described below followed by an example.

1. Teacher Talk Section: quotes from teachers describing their use of the module. This is a tool to make the module more attractive for teachers considering use of FOSS.

Example from the **Variables** TeacherTips: "The Plane Sense activity in this module is so engaging and fun for students that a teacher could start the activity, go shopping at Wal Mart, stop for lunch, and return to find the class still on task and not at all wondering where the teacher went." Pat Rynearson, teacher grades 4/5, Redwood School. *(We don't recommend this.)*

2. English Language Learners TeacherTips Section: tips that enhance use of FOSS for English Language Learners.

Example from the **Human Body** TeacherTips: "Have students play Simon Says (pointing to and naming body parts) in different languages. Those learning the language watch and learn from those who know the language."

3. Behavioral TeacherTips Section: the tendency for some students to engage in negative behavior during certain activities can be headed off in advance by wise teachers.

Example from the **Magnetism and Electricity** TeacherTips: "Some teachers give their students a free exploration period with the magnets before starting the activities for this module. This makes it easier to keep students on task during the planned lessons."

4. Materials Management TeacherTips Section: techniques for making a lesson progress without problems due to materials preparation and use.

Example from the **Environments** TeacherTips: "Some teachers who were worried about having insects in their classrooms found a way to do the Terrestrial Environments activity anyway! They became experts at confining the critters by pulling nylon stockings securely over the tops of the terrariums!"

5. Extensions TeacherTips Section: describes other activities and literature that extend the FOSS curriculum concept.

Example from the **Landforms** TeacherTips: "After completing the schoolyard model activities my classes use graph paper to design and draw Perfect School."

Also included were appendices on Materials Management, English Language Learners and FOSS, and Multimedia Materials at Fontana USD Multimedia Center that enhance the use of FOSS.

Results of the entire project are currently being tabulated and analyzed. Early indications are that use of FOSS has been enhanced and increased throughout elementary schools in the district as a result of the unique project. For further information contact:
Dr. Iris Riggs (909-880-5614), Dr. Esteban Diaz (909-880-5635), or Dr. Klaus Brasch (909-880-5300) c/o CSUSB, 5500 University Parkway, San Bernardino, CA 92407.

__Curt Jacquot__ is on the staff of the California State University at San Bernardino and Project Management Assistant for the NSF project described in this article.

Ridgway High continued

office. Materials were ordered and organized in supply bins. A schedule was crafted. Kits were picked up at schools, refilled, held until needed by the next teacher, and delivered when needed for instruction.

> ***"I love putting the kits together then seeing the elementary school kids doing the activities."***
>
> Chris Bade,
> Ridgway Student

Good system, but it soon became apparent that this task required more time than the district office employees had to give.

Ron Lundy, the director of elementary education for the district, came to Ridgway High School, which happens to be located next door to the district office, and asked if Ridgway students would be interested in taking on the task of maintaining the kits.

When the idea was presented to the staff of Ridgway, the science and business teachers saw an opportunity for their students to have a real world learning experience in both science and business. And, that is exactly what is happening.

> ***"How come we didn't have science like this when I was in elementary school?"***
>
> Jose Hermosillo,
> Ridgway Student

Nancy Watanabe, a science teacher, helps half the class of about 35 students learn the FOSS activities. The students present the lessons to each other as they are outlined in the teacher guide so they become familiar with the materials and their various purposes.

The other half of the class is with Charlotte Imboden in the supply room. They take inventory and present their "shopping list" to the staff, who actually place the orders. They package replacement items that will be needed in kits, prepare consumables such as seeds and salt, and refill bottles of vinegar, soap, syrup, etc. They refill each kit after its use, label it, and place it in storage, ready to be delivered to the next school. Then they help deliver and retrieve kits at the appropriate times.

After Mrs. Watanabe's half of the class has completed a kit, they report to Mrs. Imboden for work, and Mrs. Imboden's half of the class reports to Mrs. Watanabe to learn the science in the next kit.

This semester we have had elementary school teachers requesting our high school students to be aids in their classrooms while science lessons are being taught. Because they are so familiar with the lessons and materials, we expect that our students will be of great service to these teachers.

Also, this semester Linda Hagle, a computer teacher, is working with interested students to get the inventory "computerized," which is another hands-on opportunity to learn how to set up a spreadsheet and then see it used in a real situation. She has designed letterhead for our Joint Venture program and has been instrumental in getting the student classroom aid program going.

This is only our second semester of operation. We have learned what works and what doesn't work and have smoothed out most of the rough spots. The students are taking pride in knowing their efforts are really noticed and appreciated. And, because FOSS kits were not available to our students when they were in elementary school, we think some are finally "getting" science and are truly enjoying it.

Ridgway High School students doing Solar Energy Module activity. Left to right: Nick Flanders, Cory Barnard, Robert Dijorio, Esperanza McCabe, Sarrah Standing-Elk.

***Charlotte Imboden** teaches business at Ridgway High School in Santa Rosa, CA.*

Keeping the Balance Between the Home and School

by Maria Oza

In Los Angeles at a neighborhood school in East L.A., parents attended a FOSS workshop at which they were given an overview of the program. Parents investigated science concepts involving balance and motion, the human body, and electricity using the FOSS Modules. They remarked that the materials are fun and engaging, but their concern was how to help their children with the science they are learning at school. This is a question that educators also ask... How can we connect the home with the school?

Parents investigate principles of balance in the Balance and Motion Module.

FOSS home extensions are great to begin the connection with home. However, what parents say to their children while going through the assignment or investigation is important.

The facilitator, Maria Oza, science resource teacher at the nearby Science, Math, and Technology Center, guided the parents through a series of questioning techniques, stressing not to give the answer but instead provide guiding questions to lead to inquiry and further investigations.

Keeping in mind the scientific thinking process, parents must ask questions that stimulate, motivate, and arouse children's curiosity to find out how and why things happen.

The following quotations are from parents in the workshop.

"Esto ha hacido muy interesante para mi como madre."
"As a parent, this has been an interesting workshop."

"Saber cómo hacerles preguntas a mis hijos es saber cómo puedo aprender junto con ellos."
"To know how to ask my children the right questions helps in learning together."

***Maria Oza** is a resource teacher to the East L.A. Science, Math, and Technology Center.*

Cross-Grade Level Hands-On Science

by Art Lohuis

What happens when you teach hands-on science to a combined class of first and fifth graders?

Team teaching science with a combination class of first and fifth graders was hardly a delivery system I wanted to try. But that's what I ended up doing after a chance meeting with colleague Nancy Baker in 1992.

I laid out my reasons why it wouldn't work. After all, research indicated that cross-grade teaching was optimal with a two-year difference in student age. Teaching science processes to fifth and first graders simultaneously didn't appear practical. I had almost no science materials appropriate for fifth-grade students that applied to first-, and vice versa.

SCIENCE "BUDDIES" LEARNING ABOUT STATIC ELECTRICITY.

But Nancy was enthusiastic about science and wanted to use more hands-on, process approach methods, and I wanted my older students to experience more cooperative learning. It was a conceptual challenge for this 27-year teaching veteran to get the goals of scientific literacy, developmentally appropriate material, and inquiry science in one package for that wide age spread!

With reservations, I agreed to try it for nine weeks. That summer I re-wrote a series of inquiry lessons complete with two sets of objectives. The following semester I pre-taught and re-taught lower level science skills (comparing, observing, measuring, recording) to the fifth graders prior to their meeting with their first-grade buddies. In a series of 12 discovery activities covering thematic units on gases and liquids, the fifth graders acted as mentors for the first-grade students and helped them with the processes where smaller hands and muscles had difficulty. Fifth graders read the material aloud and, in some cases, assembled difficult materials beforehand. Teachers hung back and let the students interact with the materials as the discovery process unfolded.

Our students were enthusiastic and successful with science. But there were serendipitous outcomes as well. Fifth graders who frequently displayed inappropriate behaviors with materials or had difficulty keeping on task became more involved with the activities and made better behavioral choices in the cross-grade environment. Low ability students in both grades were successful because of the hands-on investigations and exhibited more positive attitudes toward science (and school in general). The number of playground incidents reduced, and, in some cases, fifth graders were protective of their science buddies and averted problems before they became serious. And perhaps best of all, other teachers in the buildings began to use cross-grade level, cooperative activities.

In 1994, we piloted FOSS in a few elementary classrooms as part of a district science re-evaluation. I was assigned a new district-wide goal: to help elementary teachers develop skills and understanding of science concepts and get the elementary science curriculum closer to the draft standards for science instruction.

Nancy Baker and I realized that many elementary teachers were turned off by science, and we needed to build their confidence, change some attitudes, and increase understanding of science concepts. FOSS seemed like a natural way to accomplish several goals.

We conceived and implemented a three part plan:

1) Demonstrate FOSS to teachers in a classroom setting, making it as comfortable as possible for them.
2) Do a two-day FOSS in-service in the summer to generate enthusiasm and get the materials in the hands of uncommitted teachers.
3) Send six teacher volunteers to a FOSS Pre-NSTA Informational Institute lead by FOSS developers. These teachers would be our cadre of mentors and support staff.

When we showed uncommitted teachers that FOSS was a user friendly, complete curriculum, several signed up to pilot the program. Teachers moved from teaching content only to inquiry science, and slowly attitudes changed.

We brought in EBEC's Dean Taylor, a FOSS trainer and sales staffer, and did a one-day in-service for staff in two buildings. We offered two FOSS workshops for district inservice credit, after which all teachers were requested to teach a minimum of two FOSS units.

Teachers' confidence in their ability to present the curriculum increased, and several who were less confident adapted the "science buddy" model and tried cooperative teaching with older students mentoring the science for younger learners. As cross-grade level teaching continued, we found that fifth graders can help with materials preparation, maintenance, management, and inventory of FOSS kits.

The last year showed significant gains in accomplishing our goals of scientific literacy, bringing the district closer to the new science standards and implementing FOSS countywide.

Now we have another goal: to develop an evaluation program that gives longitudinal data for FOSS and student performance in science. That process will begin this year.

__Art Lohuis__ and __Nancy Baker__ presented their program "Two Heads are Better Than One. Buddy Up and Have More Fun—A Hands-on, Cooperative, Cross Grade Level Science Instruction Program" at the NSTA area conferences in Salt Lake City and San Antonio in 1995. They are elementary teachers, and Lohuis is the Elementary Science Coordinator for Teton County School District in Wyoming.

Science Reform Turns Into Success for Special Education Students

by Roger Tesi

Lisa Licari teaches a self-contained special education class for eight- and nine-year-old students. The parents of her students are enthusiastic and happy because, for the first time, their children are fully participating in a regular third-grade classroom learning an academic subject: science. For these students, the feeling that they don't belong in a regular classroom has been broken.

JoAnne Messina teaches a self-contained special education class for 10- and 11-year-old students. Her students are also excelling in an age-appropriate hands-on science curriculum, consistently scoring in the 90s and 100 on science quizzes designed for regular education students. Her students' enthusiasm and high level of success means that many science activities go on for an hour and a half.

How Did This Happen?

During the 1993-94 school year, the Bloomingdale, New Jersey, School District Curriculum Council conducted a national search for a hands-on elementary science program. The Council and staff were looking for a non-textbook, experiential approach to teaching science. They wanted students to be actively involved in constructing scientific concepts through experimentation, discussion, and analysis. After reviewing many programs over a four-month period, the Curriculum Council and several interested elementary classroom teachers chose the Full Option Science System.

The district's approach to implementation included both regular and special education students. Special education students were included in the program because the Curriculum Council believed that the special education population could benefit from this type of experiential approach as much as, if not more than, regular students.

Inclusion

Ms. Licari combined her eight students with neurological impairments with Mrs. Sellitti's 22 third graders two times a week for hands-on science instruction. Activities were designed for collaborative groups of four. Group members took turns assuming the four different roles: "getting" materials, "reading" instructions, "starting" activities, and "recording" data. A special education student participated in each group. The two teachers collaboratively planned each lesson in advance and discussed individual student roles for the learning groups.

An impressive outcome of this collaborative student group approach has been the students' ability to work independently within their groups and make decisions, solve problems, observe rules, and take initiative for both individual and group work. Prior to this experience, the special education students rarely displayed initiative and were often dependent on the teacher's direct assistance. As the special education students developed confidence in their science groups, Ms. Licari noticed an increase in their self-esteem that carried over into many other areas of their school environment.

Self-contained Classroom Success

During the 1994-95 school year, Mrs. Messina taught FOSS in her self-contained setting. As a result of the success of her science program and the subsequent student growth, her students with neurological impairments have been mainstreamed in a regular fifth-grade science class for the 1995-96 school year. Taking the same approach that Ms. Licari adopted, Mrs. Messina co-plans and team-teaches the FOSS activities with the regular classroom teacher.

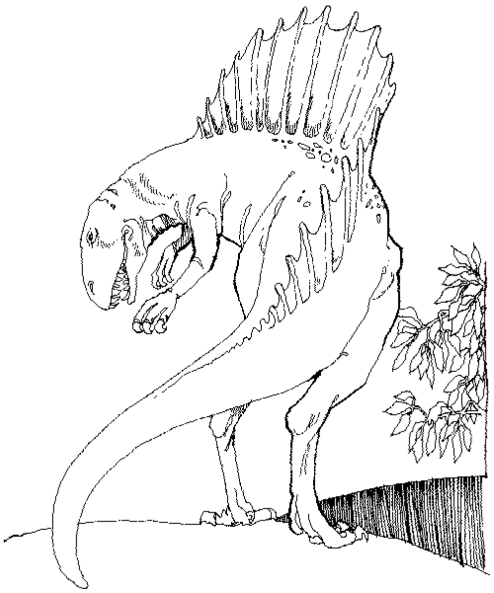
Mrs. Messina credits FOSS for the exceptional growth and success of her students in science. Her students exhibit deficits in their short-term memory. Through the use of a structured and sequential hands-on approach such as FOSS which encourages meaningful individualized experiences, useful information gets stored in the students' long-term memory banks.

The FOSS content and activity designs are highly motivating, and they stimulate student curiosity. Students are simultaneously encouraged to investigate, gather data, organize results, and draw conclusions based on their own actions and personal experiences. When compared to a more traditional elementary science curriculum design that attempts to teach students via an abstract level of understanding, FOSS is much more effective in developing both cognitive and affective domains of learning for all students.

***Roger Tesi** is Superintendent of Schools, Bloomingdale Board of Education, Bloomingdale, NJ.*

Dinosaurs in Minnesota?

An interview with Bob Madsen by Larry Malone



Spinosaurus

I was at Little Big Horn College in Crow Agency, Montana, last year working with Bob Madsen. He had invited me out a second time to help him make a FOSS presentation to teachers from the Crow Reservation who were participating in his NSF teacher enhancement project. I got to talking with Bob about our middle-school ruminations and mentioned that one of the topic areas we were considering was dinosaurs.

That got Bob started on a wonderful story. The previous year he had traveled to Johnson Ausberg College in Minnesota to visit with his NSF project evaluator. He had expressed interest in visiting a FOSS classroom while he was in Minnesota, so I suggested he call Jeff Lorton, the EBEC sales rep for the area. Jeff arranged for Bob to visit Mary Ott in Roseville schools, a suburb of Minneapolis.

On the day Bob visited Mary's fourth-grade classroom, the students were doing the FOSS **Human Body Module.** They had learned about the human skeleton and were now into owl pellets, finding and sorting the tiny bones, and comparing them to human bones. Bob offhandedly asked the students if they would like to see some bones from 100 million years ago—some dinosaur bones. Can't you just hear the student response!?

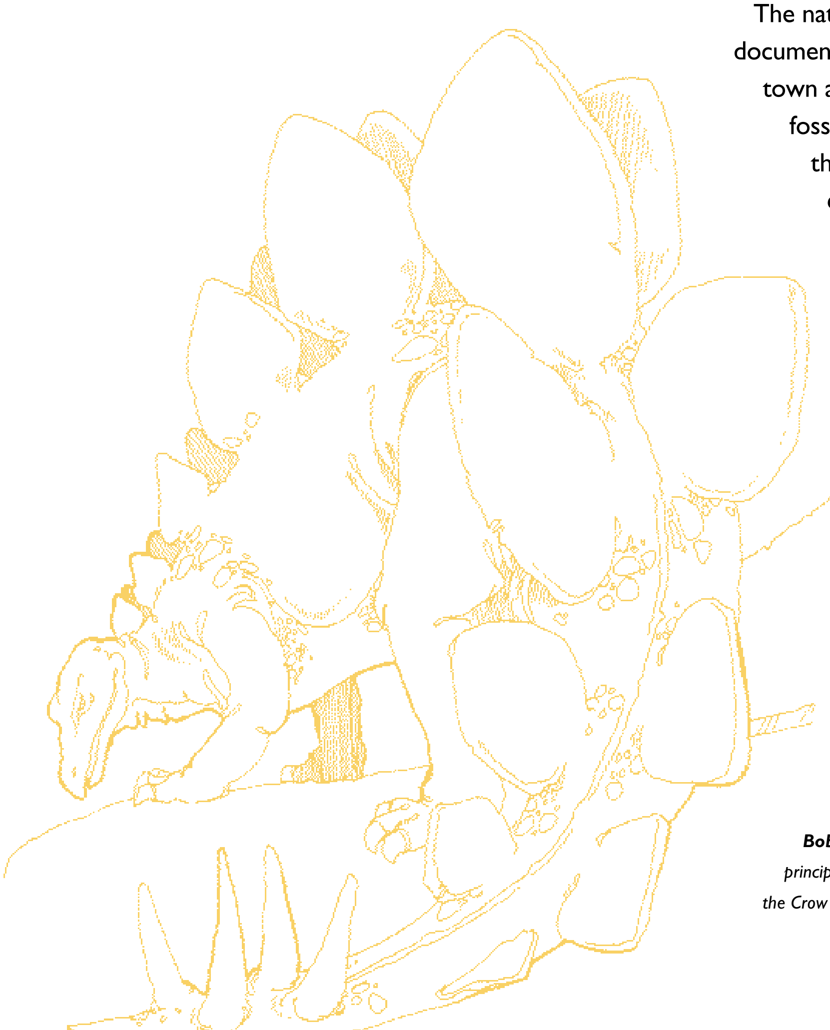
Bob returned to Crow Agency and arranged a field trip for the fifth- and sixth-grade classes at Wyola School. Wyola School is in southeastern Montana's dinosaur country, not far from the celebrated Little Big Horn Battlefield. The field trip destination was Dinosaur Hill, a knoll right in the neighborhood of the school.

The native American students clambered up the hill, and Bob documented the event on video. Students described their hometown and the prehistory of the area while they collected tiny fossil fragments of several different dinosaurs. The spoils of the day were carefully packaged for delivery to Mary's class.

Some time later the fossilized bits arrived in Minnesota. The image the students may have had about dinosaur bones—huge femurs and massive skulls full of teeth—were probably not fulfilled by the scraps they received, but that's not the most important outcome of this side trip. Students from different parts of the country with different stories to tell made contact and shared a bit of their lives. It was science that sparked the relationship and scientific knowledge that gave meaning to the fragments of ancient bones.

NOTE: As the electronic dimension of FOSS matures in the near future, it will be easier and easier to make contacts like the one described above. There will be updates in each newsletter.

***Bob Madsen** teaches sciences at Little Big Horn College in Crow Agency, MT, and is principal investigator for an NSF teacher enhancement project to work with teachers on the Crow and Northern Cheyenne Reservations.*



Stegosaurus

A Note from the Field

by Sylvia Bath

(with editor comments)

I recently received a note in my e-mail from Sylvia Bath, FOSS teacher and staff developer in Illinois. She raised a number of points that come to the heart of FOSS implementation. Here are several of her questions and observations with "official" FOSS responses. I hope these points are useful to you and spur you to offer your own comments and questions concerning FOSS implementation.

Dear Larry,
After my presentation to teachers in Frankfort [Ill.], I have some ideas for you/FOSS.

1) Why doesn't FOSS provide an appendix of most asked questions? The hands-on concept is a leap for a lot of traditional districts. I found I had the same questions over and over (actually, I'd had the same Q's myself and planned to address them).

Good idea. We have such a list (somewhat out of date) that we developed for the EBEC sales force to help them understand all aspects of the FOSS program. We will happily retrieve this document, update it, and make it available to all interested educators. (By the way, what are the questions you are most frequently asked about FOSS? We'd like to hear your top ten list.)

2) Since the idea of the teacher prep video is one the teachers dearly love, perhaps FOSS can prepare a more generic one showing/telling about the basics (classroom management, collaborative grouping, etc.). If you get into this, I'd like to help! Sounds like fun!

It does sound like fun . . . but it isn't. Video production is hard work. Be that as it may, this subject comes up with some frequency. I think a set of management and pedagogy videos would be an excellent addition to the program. Now is the time to start seeking the resources—time, financial, and human—to undertake the project.

3) The teacher notebook is great but should have a page listing the first-time module prep activities. This was vital, and I only found it in the leadership book.

Right now that comprehensive list of one-time preps appears only in the FOSS Leadership Trainers Manual. We will gladly supply a copy of this document to interested educators so that they can retrofit their manuals, and we can incorporate this information into the next edition of the Teacher Guides.

4) The basic supply list is pretty much buried just before assessment. It would be better in the front as someone is beginning to examine the module's components (I think).

This is a tougher call for me. Experienced teachers often move the comprehensive materials inventory list right up front as you suggest. They actually cut up the replacement parts catalog and put the replacement parts sheet for that module right with the inventory sheet so they are both right there facing each other. This makes reordering much easier.

But, when a teacher is launching his or her FOSS career, I'm not sure that the comprehensive list of materials is the most comforting thing to encounter right off. We can easily change the organization of the Teacher Guide, but before we do I want a little more evidence from the field that this is the best presentation.

5) Some teachers found some assessment items (and prep) not listed anywhere except in the actual assessment. Again, I really think this ought to be found way in the beginning with any other prep & materials section. Fourth grade teachers squawked at the chicken bone preparation!! **[Human Body Module]** This took a week or two planning just to prepare the chicken bone assessment.

And imagine the squawking offered up by the chicken! Yes, a comprehensive listing of the preparation, including the assessment prep, will be included in the revision, as mentioned above. This is absent from our listing in the leadership guide—we will attend to this oversight at once.

6) In **Mixtures and Solutions,** teachers said that Kool-aid has changed their scoop size (no longer 50 ml) and the one included didn't work for the activity. Why not include a 50-ml scoop in that module?

This may seem hard to believe, but Kool-aid™ did not consult with us before changing the scoop in their product! We can put a 50-ml scoop in the kit. In the mean time, you can use the 25-ml scoop in your **Measurement Module** *and make twice as many moves to the Kool-aid™ source as suggested in the manual.*

7) Some teacher observation checklists might prove helpful for teachers in day-to-day assessment. I gave the teachers three different types which I'd developed—they were very happy.

Great! Send us your checklists and we'll print them in the next newsletter.

Thank you, Sylvia, for your insightful list of questions and suggestions. Some of the implied changes will be difficult to implement until we undertake a revision of the Teacher Guides, and at this time there is no time schedule for the revision. But it will happen, so please, one and all, send in your suggestions for improving and extending the FOSS program.

Sylvia Bath *is a 4th-grade teacher and the Science Leader for her school in Lake Zurich, IL.*

How to Stretch a FOSS Kit

by Laura Louttit

When faced with the prospect of using a FOSS kit with more than one class, teachers often ask what to do. For example, if you are team teaching, you may teach two science classes back to back. Or if a school uses a resource room model where FOSS is taught to all the students in a designated science room, a lesson may be taught four or five times in a day. This often means that there will be only a few minutes to clean up from one active science lesson and prepare for a repeat. The fact is that FOSS wasn't designed to be used with multiple classes in back-to-back sessions, but with a little planning and a few investments, those kits can be stretched beyond their original expectation.

I'll start with the assumption that multiple kits are not an option, because if you have access to a kit for each class, you will have plenty of materials, and advanced prep for each class is straight forward. With multiple kits you can set up ahead of time, but do everything double or triple, sort of like doubling or tripling a recipe. However, this may not be an option for your school.

If you have only one kit to work from, you may want to think about creating an auxiliary kit of additional items specifically for each module you will be using. Some items stay in use for extended periods of time, like aquariums, insect vials, planter cups, and evaporation dishes. These and the consumable items (seeds, chemicals, food coloring, and so forth) are obvious items for the auxiliary kit. You might also consider some convenience items for the auxiliary kit as well, like some extra basins, cups, half-liter containers, and pitchers.

To design an auxiliary kit, first go to your FOSS Teacher Guide and find the Kit Inventory and Organization page. This list is always found on the last page before the Assessment tab in the Teacher Guide. Make a copy of this inventory to work from. Then, with your list in hand, review each activity carefully (particularly the Materials and Getting Ready sections) and decide if you need to increase the quantity of any items to get through back-to-back classes. You may want to organize your plan using a form like the one discussed later in this article.

Some modules like **Levers and Pulleys**, **Magnetism and Electricity**, **Sound**, and **Balance and Motion** have virtually no consumable materials and no systems that need to grow or develop over time. Materials in these modules are easily distributed, used, and collected. The trick is to do it with grace and alacrity. I might suggest putting a set of basins and some half-liter cups into your auxiliary kits for these modules. Small items can be put in half-liter containers and the whole collection of student materials for a collaborative group or table group put into a basin. This way the items can be quickly inventoried and easily carried to the materials center in a condition ready for redistribution a few minutes later.

Structures of Life, **Water**, **Environments**, **Mixtures and Solutions,** and their ilk, however, present a different challenge. The seeds and chemicals are supplied for two class uses, but the containers used for sprouting the seeds, the bus trays for keeping crayfish, and the flat containers for evaporation will be in use by each class for an extended period of time. You will want a full complement of sprouting materials, crayfish habitats, etc. for each class in your auxiliary kit.

You will need room for each class to maintain their organisms and observe their crystals develop. Unfortunately, this space cannot fit into the auxiliary kit. In an itinerant science teacher model where science comes to the students in their own classrooms, space should be no problem. But when the students come to science, as in a resource room model, space gets filled quickly. Sometimes it is necessary to compromise by setting up experiments or habitats in the resource room and then moving them to the students' regular classrooms for maintenance and observation. Either way, smooth operation calls for extra materials on hand and management strategies for efficient movement of materials through the learning environment.

Two of the primary life science modules are designed with the option of being used by two classes at the same time—**Insects** and **New Plants**. In this case the classes will not be doing the same activities but rather sharing the equipment over time. In the overview

Module title ______________________ Kit number __________

FOSS KIT RETURN FORM

Name ______________________ School __________ Room ______

Inventory the kit carefully after you have used it. In the spaces below indicate both the consumable materials and permanent equipment that need to be replaced. Make a copy of the completed form. Attach one copy to the kit and keep one copy for your records.

CONSUMABLE	PERMANENT

Module Preparation Sheet

FOSS Module ________________________ Number of classes __________

Activity	Activity	Activity	Activity
Part	Part	Part	Part
Materials supplied by teacher	Materials supplied by teacher	Materials supplied by teacher	Materials supplied by teacher
Sheets to be copied	Sheets to be copied	Sheets to be copied	Sheets to be copied
Prep before the lesson	Prep before the lesson	Prep before the lesson	Prep before the lesson
Materials for each group	Materials for each group	Materials for each group	Materials for each group

for these modules there is information to help two teachers plan how to share the kit. For example, on Page 5 of the **New Plants Module** Overview you will see the following helpful hint.

"If two teachers are sharing one kit, one class should start with Activity 1 and go on to Activity 2, completing both in five weeks. The second class should start with Activity 3 and go on to Activity 4, completing those in five weeks. Then the equipment can be swapped."

When you share a kit, either simultaneously or sequentially, it is essential that you work out a system for monitoring consumable items so that the next teacher using the kit will know exactly what is needed before beginning the module. I like to use the kit Inventory and Organization Sheet for this purpose. I make a copy and keep it taped to the top of the FOSS module box. At a neighboring school, teachers fill out a custom form when they are done using the kit. The sheet had the name, room number and a "This kit now needs" section with room to write the items and materials that need to be replaced in the kit. This form was simply printed out on the computer.

Here's another great idea shared by an experienced FOSS teacher. She wanted to have a tool to assist her with preparation for each part of each activity as she got ready for multiple classes. As she read through an activity folio in the Teacher Guide, she would extend numbers and take notes on:

- the quantity of materials she needed to provide,
- the number of copies of student sheets she needed to make,
- preparation required for each part of each activity, and
- materials needed for each group.

She designed a form on which to organize these notes. After completing the notes for a module, she placed the notes in her lesson plan book for constant reference. A copy of her note organization sheet is above.

These are just a few ideas to help with your planning for materials management and to keep your FOSS science program running smoothly. If you have experience stretching a FOSS kit to cover the resource room model, back-to-back classes, or a double-sized class, send them along to the FOSS people and they will share them in this newsletter.

Laura Louttit *is an experienced upper-elementary FOSS teacher from Spokane, WA, currently living in the San Francisco Bay Area. Laura works now as a FOSS implementation specialist and as a staff developer with the Sandia National Labs LASER Project in Alameda City Schools in California.*

Editor's note: The FOSS staff is working on developing content lists for auxiliary kits for each FOSS module to help resource teachers who are using FOSS with two, three, and four classes a day. This document should be ready around March 1. To request a copy of the Science Resource Teacher Auxiliary FOSS Kits, drop us a note at:

FOSS
Lawrence Hall of Science
University of California
Berkeley, CA 94720
FAX 510-642-1055

72 % of the members of Congress believe that psychics can predict the future.

About 50% of the editors of newspapers believe that humans lived at the time dinosaurs roamed the Earth.

A state level superintendent of schools believes that the Earth was created 8000 years ago. (Excerpts are from a survey news report, ABC News, San Francisco 1-1-96.)

Benchmarks and Standards: An Historical Perspective

by Professor Lawrence Lowery

Precursors to a Reform Movement

In April 1983, one of the most important reform publications of this century, *A Nation At Risk,* was released.[1] It warned that if our educational enterprise continues to develop a citizenry that is illiterate in the areas of mathematics, science, and technology, our nation will lose its influential position among other nations and become a second-rate power in the 21st century.

Consider: If the leaders of our country are illiterate in these areas, they are likely to make uninformed and unwise decisions concerning them. If, similarly, the communicators of our country are illiterate, they are likely to impart misconceptions and misinterpretations. If the educators of our country are science and math illiterate, the lack of understanding of these areas will be perpetuated through future generations of school children.

Fortunately, *A Nation At Risk* initiated a mixture of studies and other endeavors that have currently coalesced into a significant broad-based reform movement in education.

Among the first studies undertaken were efforts to compare the literacy levels of U.S. students with the literacy levels of students in other countries. Although many of the studies had poor designs, making their findings invalid, the better studies consistently found that there was much room for improvement in the teaching of mathematics and science in this country.[2]

Other studies looked at causes for the illiteracy problem. Some found that the preparation of elementary teachers in the areas of science and mathematics was inadequate, that very little science was being taught in elementary schools, and that the standards for science and mathematics were dictated by marketing decisions within publishing companies rather than by scientists and educators. Textbooks were analyzed and criticized for "dumbing down" the curriculum and reducing teaching to a management system for assigning reading and evaluating recall of what was read.[3] And because most elementary school teachers are female, quite a few studies looked at influences that deter women from taking courses in the fields of math and science—influences that can affect the way they teach or do not teach.[4,5,6,7]

Beginning the Reform Movement

One of the earliest efforts to bring about change was initiated by the National Science Foundation in 1986 with the announcement of a new program, called Triad, to support a modest number of major curriculum projects at the elementary and middle school levels. The announcement was intended to stimulate a period of intense development, much like the 1960s, but with several fresh considerations. New curriculums would be designed to:

- respond to the needs of every student, not just those who were college bound;
- provide a materials-centered active-learning experience, unlike the experience provided by textbook programs;
- take advantage of current knowledge about how people learn; and
- produce products that were market ready with the advice and assistance of a commercial publishing partner.

In the next two years, NSF funded 7 elementary projects—*The Full Option Science System (FOSS)* was one of them.[8]

Although there are similarities among the Triad curriculums, each has its own viewpoint and ways by which it developed and tested materials and activities. A major strength of the FOSS development model was the extensive testing by teachers across the country, including "science-reluctant" teachers, those teachers that research studies had identified as a priority for science education reform. This testing was done for the purpose of learning how materials, management, and program design could be conceptualized to enable novice teachers to overcome the misconceptions, inadequate preparation, and negative societal influences preventing them from being successful science teachers. The result is that FOSS is what educators are calling a "teacher friendly" program:

- The Teacher Guides are flexible and clearly written and serve the needs of both novice and experienced science teachers.
- Laboratory kits contain virtually all the materials needed for large class sizes so that teachers do not have to scrounge items or buy materials with their own money.
- The materials are enhanced by video preparation tapes that enable teachers to see what the instruction might look like in a classroom before they teach a lesson.
- The language arts and math components are fully integrated into the science activities, inseparable from the wholeness of the experience.
- Assessment tools and methods are part of the program.
- In-service is provided to help with the implementation of the program following purchase.

The accessibility of FOSS has increased the likelihood that non-science teachers will try to teach science in a manner that is quite different from the traditional textbook approach. And by trying different ways to teach science, it is expected that teachers will increase their knowledge of science content and inquiry methods, refine their knowledge of children and how they learn, and become more confident and expert in the teaching of science.

Another early effort to bring about change was initiated in 1986 by the American Association for the Advancement of Science (AAAS). Under the leadership of F. James Rutherford, chief education officer at AAAS, Project 2061 was established. This project takes a long-term view of educational reform in the sciences (75 years—from the last appearance of Halley's Comet in 1986 to its next appearance in 2061), and it intends to produce a sequence of strategy documents and planning guides that will precede the implementation of the ideas. The project's broad goal is to develop a high level of scientific literacy among all American citizens. Its first major publication in 1989, *Science for All Americans,*[9] makes recommendations for the basic learning goals in science for all students. It emphasizes that schools do not need to teach more content, rather, schools should teach less content, but powerful content, in better ways and in depth. In 1993, Project 2061 released a draft of a second important document that built upon the prior work. Called *Benchmarks for Science Literacy,*[10] the document establishes minimum criteria against which educators and school systems can match their efforts to improve science instruction.

Benchmarks describes expectations for science programs in schools. This well-written, easily-read document covers important aspects of curriculum changes beyond the traditional listing of content objectives. It clearly states that children change over time and that the learning of science as an enterprise must respect and follow that change through the school years. It emphasizes that it is not sufficient to just read about science or demonstrate and lecture in a show-and-tell manner, but that learning the essence of the enterprise—the modes of inquiry, the procedures for gathering, organizing, and analyzing data in intellectually honest ways within the realms of content areas—is more important than the teaching of facts to be memorized.

Although *FOSS* and *Benchmarks* were developed independently, they both grew

EARTH SCIENCE COMPATIBILITY COMPARISON: BENCHMARKS AND FOSS (direct quotes)

BENCHMARKS FOR SCIENCE LITERACY	FOSS FOR SCIENCE LITERACY
K through Grade 2 Chunks of rocks come in many sizes and shapes, from boulders to grains of sand and even smaller. *Students should become familiar with all aspects of their immediate surroundings.*	**Grades 1 through 2** **Pebbles, Sand, and Silt Module:** Rocks can be sorted into groupings by their properties; rock sizes can be separated by screens and by settling in water; rocks of all sizes are found in nature and in our built environment. *Students study the properties of rocks and soil. They group and seriate rocks on the basis of single, observable properties, learning simple ways by which earth materials can be organized. They take a field trip to discover pebbles, sand, and gravel in the environment.*
Grades 3 through Grade 5 Rock is composed of different combinations of minerals. *Students should become adept at using magnifiers to inspect a variety of rocks.*	**Grades 3 through 4** **Earth Materials Module:** Rocks can be separated into their component parts; Rocks are composed of minerals that cannot be physically broken apart any further. *Students examine rocks in detail, discovering they are made up of various combinations of minerals. Rock and mineral properties are used to identify them by similarities and differences.* **Grades 5 through 6** **Landforms Module:** Landforms that result from running water include canyons, deltas, and alluvial fans; the slope over which a river flows has an influence on the land-forming processes; topographic maps are two-dimensional representations of three-dimensional surfaces. *Students test relationships (amount of water, steepness of slope) between flowing water and earth materials and determine the effects of erosion and deposition in the creation of landforms; topographic maps are created and used as a means for representing landforms.*

CHART I

REFORM CHANGES IN EDUCATION

	NON-TRADITIONAL LEARNING ENVIRONMENT	TRADITIONAL CLASSROOM
STUDENTS	Students as collaborators - researching and teaching.	Passive recipients of information provided by teacher.
TEACHER	Model learner and thinker. Guide and facilitator.	Provider of knowledge. Classroom manager.
CURRICULUM	Learning to learn and thinking as basic skills.	Basic skills distinct from higher order thinking.
CONTENT	Depth rather than breadth. Integration of basic skills (reading, writing, etc.) in service of learning coherent curriculum.	Broad coverage of content. Fragmented curriculum.
COMPUTERS	Tool for intentional reflection and creation of extended community.	Drill and practice. Programming.
ASSESSMENT	Performance/projects/portfolio. Knowledge discovery and utilization of processes.	Fact retention. Traditional, standardized testing of knowledge.

CHART II

from the same set of education concerns and drew ideas from extensive academically-based research. They are, thus, highly compatible. Chart I gives an indication of the compatibility. It reproduces in the left-hand column, excerpts of content goals from the *Earth Science* section of the *Benchmark* document. The adjoining column excerpts the *Earth Science* content goals developed for *FOSS*. There are several things to note between the columns:

- The placement of content goals through the grade levels corresponds very well.
- The content goals are progressive in an identical way with each subsequent goal building upon prior goals through the grades.
- Although the phrasings used to describe the goals are different, each conveys a deeper message—that learning is nat-ural and must be acquired through direct experiences by the learner.

With only minor exceptions, similar correspondences are found between the other content areas. From their inception, *FOSS* and *Benchmarks* have been contributing to the growing reform movement in parallel and compatible ways.

Establishing the Reform Movement

In 1989, President Bush recognized the seriousness of the education problem and sent a letter to the governors of the 50 states inviting them to attend an education summit meeting in Washington, DC, for the purpose of developing strategies for revolutionary changes in public education. It was only the fourth time in American history that a president felt the need to call such a gathering to resolve a problem. The meeting produced *America 2000,* a major report that identified a set of national education goals, and which called for the reinvention of curriculums to attain those goals.

When the Clinton administration came into office, the goals were broadened, renamed *Goals 2000*,[11] and funded by Congress in 1994. *Goals 2000* reasserted the mounting evidence that teachers were underprepared and science instruction was out of date and failing to prepare students for active roles as responsible citizens. The funding supported, among other things, the development of content area frameworks for public education—frameworks that call for demanding academic and assessments standards.

Currently, all subject matter fields in education have formulated or are formulating national standards that describe what students should know and be able to do. The first to complete its task was the National Council of Teachers of Mathematics (NCTM). In 1989, it released its *Curriculum and Evaluation Standards for School Mathematics*.[12]

The National Science Education Standards (NSES), developed under the auspices of the National Research Council, was published in December of 1995.[13] The document includes standards for teaching, professional development, assessment, content, program development, and the performance of educational systems. Like the NCTM standards, the content section outlines what a literate person should know and be able to do. It is important to recognize that the content section emphasizes standards not usually found in science frameworks and curriculums. It emphasizes the value of scientific inquiry and the relationship of science to personal, social, and historical perspectives. It is also important to note that the content section is placed well into the interior of the document and that by doing so, it conveys the message that the standards for teaching, professional development, assessment, and system performance—are just as important as the content standards in the systemic reform process.

FOSS is compatible with the spirit of the *NSES*. The two share a commitment to:

- reduce the number of topics to be taught;
- allow students time to explore and learn important ideas well;
- sequence ideas and processes so that they are developmentally appropriate;
- create assessments that are designed to provide information to students and teachers so that they can better plan what they should do next; and
- integrate technologies in a way that extends and enhances the community of the classroom.

Carrying Out the Reform Movement

To help implement the *NSES*, the National Science Teachers Association has prepared a set of guidelines, *NSTA Pathways to the Science Standards—Guidelines for Moving the Vision into Practice,*[14] and *Project 2061* is preparing other documents that can guide school districts and materials developers as they create and implement new curriculums.[15] Chart II highlights six aspects of education that are undergoing reform changes to achieve literacy goals. The chart provides a sense of the direction of the changes from the traditional classroom to a learning environment classroom. For the chart, each aspect and its change was derived from the *Benchmarks* and *NSES* documents.

This brief historical perspective conveys the idea that reform is broad, pervasive, and long-term, and that *Benchmarks* and *NSES* are two of the many important documents that help guide the reform of American education. They provide a place to begin our thinking about the many aspects that must be coordinated in order to carry out reform. But we must be alert to the possibility that these documents might be misused. If they are employed for the purpose of promoting and marketing a curriculum (several textbook programs claim they comply with *Benchmarks* and *NSES* and offer proof by emphasizing only a content correlation), schools will remain unchanged and the goals of reform will not be accomplished.

By themselves, *Benchmarks*, *NSES*, and *FOSS* will not assure school reform, but they all can play important roles in the process of school improvement. They each can contribute to effective science education outcomes when implemented in a thoughtful, long-term school improvement plan.

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New from the Wordsmiths

Since we began searching books for inclusion in the FOSS FACTs sections of each module about eight years ago, we've reviewed a number of good nonfiction and fiction books to complement the activities. Unfortunately, another thing we have discovered is books come and go. Many of the books we included in the FACTs and in the BSS Reading Resource package are now out of print. So we continue the process of looking for good books to enhance student involvement in FOSS activities through reading. The following are just some of our latest finds. As always, we'd love to hear from you about great books you use and how you incorporate them into a FOSS module.

Grades K–2

A Beekeeper's Year
By Sylvia A. Johnson. Little, Brown and Company, Boston, 1994. Photographs by Nick Von Ohlen. **(Insects Module)**

Follows a beekeeper through the four seasons, showing how bees and humans work together to make honey.

Mobiles: Building and Experimenting with Balancing Toys
By Bernie Zubrowski. William Morrow and Company, Inc., A Beech Tree Paperback Book/A Boston Children's Museum Activity Book, 1993. Illustrated by Roy Doty. **(Balance and Motion Module)**

Constructions and experiments with different toys and mobiles introduce the basic principles of balance.

Tops: Building and Experimenting with Spinning Toys
By Bernie Zubrowski. William Morrow and Company, Inc., A Beech Tree Paperback Book/A Boston Children's Museum Activity Book, 1989. Illustrated by Roy Doty. **(Balance and Motion Module)**

Instructions for designing and building tops and yo-yos in different shapes and with various materials.

Grades 3–4

Blinkers and Buzzers: Building and Experimenting with Electricity and Magnetism
By Bernie Zubrowski. William Morrow and Company, Inc., A Beech Tree Paperback Book/A Boston Children's Museum Activity Book, 1991. Illustrated by Roy Doty. **(Magnetism and Electricity Module)**

Presents experiments and projects designed to reveal various aspects of electricity and magnetism.

Blue Potatoes, Orange Tomatoes: How to Grow a Rainbow Garden
By Rosalind Creasy. A Sierra Club Book, Sierra Club Books for Children, San Francisco, 1994. Illustrations by Ruth Heller. **(Structures of Life Module)**

Describes how to plant a variety of colorful vegetables, including red corn, yellow watermelons, and multicolored radishes.

The Plant-and-Grow Project Book
By Ulla Dietl. Sterling Publishing Co., Inc., New York, 1993. Illustrated by Ulla Dietl. **(Structures of Life Module)**

Encourages youngsters to grow plants of all kinds from seeds, cuttings, and sprouts. Includes easy-to-do experiments using materials often available in the kitchen.

Water, Water Everywhere
By Mark J. Rauzon and Cynthia Overbeck Bix. A Sierra Club Book, Sierra Club Books for Children, San Francisco, 1994. Photographs. **(Water Module)**

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

Grades 5–6

Kids in the Kitchen
By Micah Pulleyn. Sterling Publishing Co., Inc., A Sterling/Lark Book, 1994. Photographs by Evan Bracken. Index. **(Food and Nutrition Module)**

A variety of simple recipes for food that is good for you and tastes great, too. Includes recipes for some all-time favorites, including pizza, animal crackers, burritos, and banana boats. Sidebars include information about the origin of the food or recipe. A glossary of terms is also included.

The River
By Gary Paulsen. Dell Publishing, A Dell Yearling Book, New York, 1991. Paperback. **(Landforms Module)**

Two years ago Brian was stranded alone in the wilderness for 54 days with nothing but a small hatchet. Now the government wants him to do it again to demonstrate the survival techniques he used to keep himself alive. Only this time he isn't alone, and his companion is soon hurt in a freak accident. Brian must build a raft and, using the only map he has, navigate to safety. This book is a sequel to another book by Gary Paulsen called **Hatchet**.

Simple Chemistry Experiments with Everyday Materials
By Louis V. Loeschnig. Sterling Publishing Co., Inc., New York, 1994. Illustrated by Frances Zweifel. **(Mixtures and Solutions Module)**

You can find the basis of a simple chemistry set just by perusing your own kitchen. Jars, frozen-food trays, plastic cups, spoons, salt, water, sugar, vinegar, and baking soda are just some of equipment needed to perform some interesting experiments, including making maple sugar candy and mouth-puckering pickles.

More Spanish-Language Books for FOSS

Maria Oza from the East Los Angeles Science and Math Center has updated her list of Spanish-language titles that can be integrated with FOSS activities. Here are some of her latest selections.

Air and Weather Module

Colección jugando con la ciencia—Aire (nonfiction)

El viaje de Babar, by Jean de Brunhoff (fiction)

El viage en globo de Guillermo, by Reiner Zimnik (fiction)

Human Body Module

El cuerpo humano—Sigmar editorials (nonfiction)

Atlas del cuerpo humano (nonfiction)

¡Esqueletos! ¡esqueletos!, by Kathy Hall (nonfiction)

Insects Module

¡Insectos! by Patricia and F. McKissaca (nonfiction)

Magnetism and Electricity Module

Colección jugando con la ciencia: Electricidad y imanes (nonfiction)

Water Module

Colección jugando con la ciencia: Agua (nonfiction)

Software Reviews

Since the FACTs were developed for the FOSS modules, a lot of software has appeared on the scene. Some of these programs would make good extensions for some of the FOSS activities. The following are just some of the programs that we have reviewed here at the Lawrence Hall of Science. As usual, if you're using any software to enhance the FOSS program, we'd love to hear your reviews.

Adventures with Oslo: Tools and Gadgets

Science for Kids, Boston Museum of Science

(Levers and Pulleys Module)

The tools and gadgets in this program involve many of the ideas students explore in the FOSS **Levers and Pulleys Module**. The CD includes an animated storybook about a llama named Dolly who needs to be rescued by a fellow named Jimmy who turns into the shapes of many simple machines; an adventure game that takes the player through a search of Tooltown and the Valley of Machines; a coloring gallery; a maze arcade; and an interactive database that includes information about the six simple machines. *Available for Macintosh® and Windows™.*

Gizmos & Gadgets!

The Learning Company

(Ideas and Inventions, Magnetism and Electricity, Levers and Pulleys, and **Models and Designs Modules)**

Gizmos & Gadgets! allows children to experiment with basic principles of physical science. They solve interactive puzzles dealing with many aspects of physical science, including simple machines, scales, force, magnetism, electricity, and energy sources. For example, a puzzle might involve constructing electrical circuits and rewiring existing ones. As they solve the puzzles, players collect parts from a warehouse to build racing vehicles to race against Morty Maxwell, the Master of Mischief. If a player doesn't win the race the first time, he or she can go back to the drawing board to figure out ways to build a faster vehicle with different parts. This program is a good extension to many of the modules in the FOSS Physical Science and Scientific Reasoning and Technology Strands. *Available for Macintosh® and Windows™.*

How Your Body Works

Mindscape

(Human Body Module)

After they load this CD, students explore a laboratory where they find a fun, easy-to-use 3-D journey through anatomical and physiological systems. The software focuses on the body's processes, not just its organs. This adventure in anatomy showcases a variety of multimedia features, including 12 richly detailed 3-D animated body tours, reference sections, and over one hour of full-motion video, original music, and stereo sound. *Available for Macintosh®.*

Introduction to Topographic Maps

TASA Graphic Arts, Inc.

(Landforms Module)

This CD would be a great review and extension to the activities in the FOSS **Landforms Module**. Students review how to read elevations from a topographic map, identify landforms, practice drawing contour lines from known elevation points, and construct topographic profiles using a slightly different technique from the one learned in the module. There is also a nice demonstration of vertical exaggeration, or how the vertical scale of a profile is often greater than the horizontal scale in order to enhance the shape of the land. The disk also includes information about public land surveys, map scale, aerial photographs, and remote sensing plus an illustrated glossary. You can view a demonstration of this software, plus others, on the TASA Home Page on the Web (http://www.swcp.com/~tasa/tasacds.html.) *Available for Macintosh® and Windows™.*

SimCity 2000

Maxis

(Landforms Module)

SimCity 2000 has been described as the ultimate city simulator, and more. The following software is available on one CD: SimCity 2000, the SimCity 2000 Urban Renewal Kit, and SimCity 2000 Scenarios Volume 1: Great Disasters and plus bonus cities and scenarios. Students can design, build, and customize any city imaginable. One of the interesting features that would make it a good extension to the **Landforms Module** is the terrain-modifier. Before starting a simulation, students can change the landscape, adding or moving mountains, creating valleys, canyons, and more. The only problem with SimCity is that it's hard to stop playing. *Available for Macintosh®, Windows™, and IBM.*

Widget Workshop

Maxis

(Ideas and Inventions, Magnetism and Electricity, and **Models and Designs Modules)**

Turn your students into inventors. This program puts them in a lab setting with hundreds of fun and realistic objects (such as light switches, gravity chambers, pulsing hearts, and so on) that can be connected in unlimited ways. Players design and construct their own experiments or inventions or solve puzzles. Once built, kids can share self-running versions of their inventions with friends. The software package also includes additional items for inventing both on and off the computer, including a wooden top, thermometer, compass, magnifier, straws, and rubber bands. These objects can be used in innovative experiments that integrate concrete objects and computer imagery. An experiment book is also included. *Available for Macintosh® and IBM.*

More On-line Connections for FOSS Modules

If you have access to the World Wide Web (the Web), you have a great opportunity to enrich FOSS science activities. Here are just a few of the Web Sites we have discovered recently.

Food and Nutrition Module

Food and Nutrition Information Center Home Page
http://www.nalusda.gov/answers/info_center/fnic/fnic-etexts.html

This page includes links to a number of electronic sources of food and nutrition information on the Web. The table of contents includes links to multitudes of things including software, clipart, recipes, and product labeling. The section on product labeling includes the FDA/USDA Food Labeling Education Information Center. Students can also browse the Food Guide Pyramid Users' Data Base.

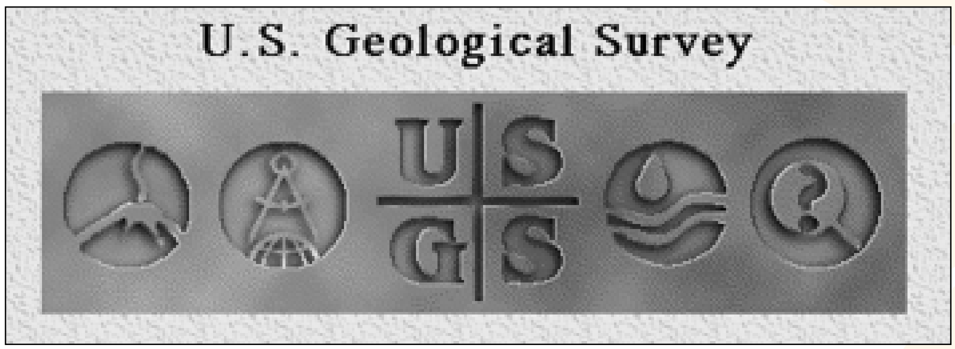
Insects Module

Monarch Watch
http://129.237.246.134/

The Department of Entomology at the University of Kansas is now in their fourth year of an outreach program they call the Monarch Watch. Their goal is to advance the cause for science education, especially in primary and secondary schools, as they promote conservation of monarch butterflies. Thousands of students and adults participate each year in a cooperative study of the monarchs' fall migration. The Monarch Watch Home Page is a great source of information about a host of monarch-related topics, such as monarch life history, frequently asked questions (FAQs) about monarchs, how to raise monarchs, and ideas for butterfly cages.

Earth Science Strand

There are several sites on the Web that deal with the earth sciences in general.



U.S. Geological Survey
http://www.usgs.gov/

The USGS Home Page is just the beginning of a tour through a number of earth science information sites. You can connect to USGS Fact Sheets and Information Releases and to information about USGS Publications and other data products, including aerial photography and topographic maps. One site under development through USGS is called the Learning Web (http://www.usgs.gov/education/othered.html). From this page you can connect to curriculum ideas and to a page called "Ask-A-Geologist," where students can ask questions of and receive answers from a USGS geologist.

Earth Science Emporium
http://nlu.nl.edu/bthu/nlu/eight/es/Home page.html

At the Earth Science Emporium, you can find links to a variety of interesting sites for earth science educators and enthusiasts. Subtopics include general earth science, astronomy, geology, meteorology, and oceanography. For example, under the Geology heading students can connect to an on-line mineral collection complete with photographs and information about many of the minerals (such as calcite) introduced in the **Earth Materials Module.** This Home Page also includes a Meta-Index of earth science resources.

Kids as Global Scientists
http://stripe.colorado.edu/~kgshtml/Home.html

Although this project is developed for students in middle school, it deals with the subject of weather and may be of interest to students who have traveled through several modules in the FOSS Earth Science Strand. The project focuses on maximizing the educational potential of an Internet-based middle-school weather curriculum. Students collect their own weather data (wind speed and direction; cloud observations) which they share through a Global Exchange. For more information about KGS, contact Dr. Nancy Butler Songer or Holly Devaul at the KGS electronic mailbox (kgs@spot.colorado.edu).

Landforms Module

UC Berkeley Library Web
http://www.lib.berkeley.edu/EART/digital/topo.html

General information about topographic map and map samples can be viewed through the University of California at Berkeley Library Web. The samples are maps from the UC map collection and include maps from Egypt, Vietnam, Switzerland, and one of Mt. Kilamanjaro (to compare to Mt. Shasta). You can also link to an explanation of topographic map symbols, similar to the pamphlet published by the U.S. Geological Survey.

If you are able to do a search via an engine like Yahoo or Lycos, type in the words "topographic map." This can lead you and your students to a variety of sources of information and on-line maps that may pertain to your state or local area.

U.S. National Parks
http://www.nps.gov/parklists/byname.htm (not a typo)

This Web Site lists all of the national parks, monuments, and historical sites in the United States. Some (but not all) of the national parks, like the Grand Canyon, have extensive information including trail maps and photographs of park attractions. This site could help students develop an on-line field trip to accompany their study of landforms.

Grand Canyon River Run
http://river.ihs.gov/GCMAIN.html

Billed as The Unofficial Guide to the Colorado River in The Grand Canyon, this site includes a multimedia river trip, complete with maps, photographs, sounds, and movies of sites experienced by Colorado River rafters. At this writing, there is even a QuickTime movie of a group of rafters running Lava Falls, one of the most intense and turbulent falls on the river. This site allows you and your students to vicariously experience life on a raft on the Colorado River.

Water Module

Water– Managing a National Resource
http://h20.usgs.gov/public/wid/html/wtrmgt.html

This site created by the USGS provides links to maps, reports, and other information dealing with America's water resources. The index of subjects links the user to resources such as flood forecasting, reservoir management, ground water, water allocation, and water quality. This site could be of interest to students who want to find out more about water quality and use in their own areas, especially after they complete Activity 4 in the **Water Module.**

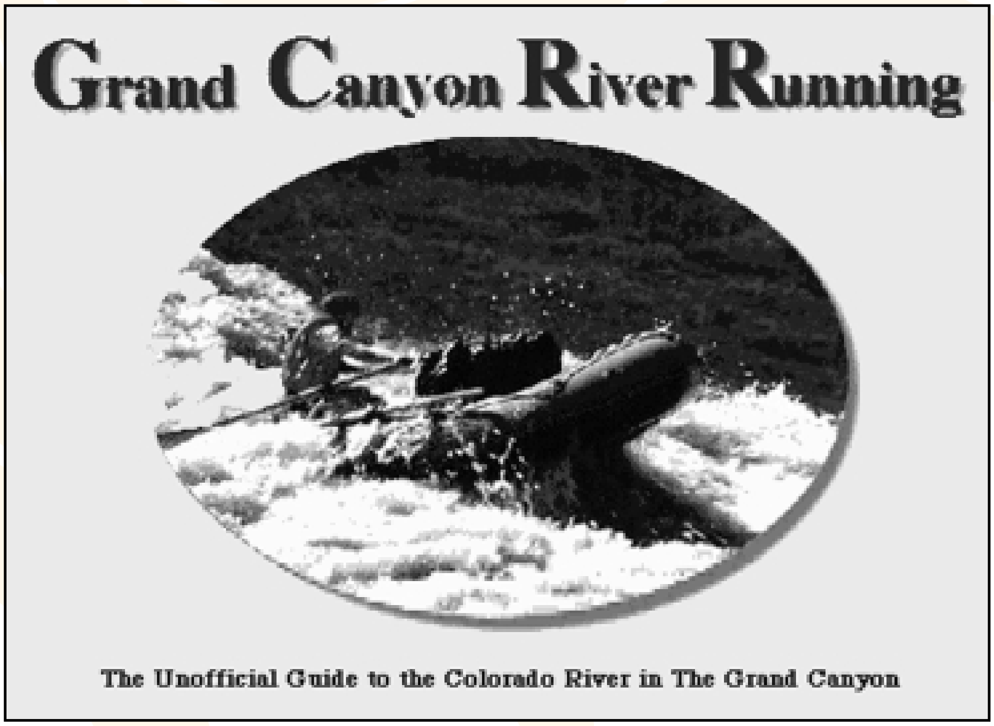
Air and Weather Module

WeatherNet
http://cirrus.sprl.umich.edu/wxnet/

For anything and everything you want to know about the weather, all you have to do is connect to WeatherNet, "the Internet's premier source of weather information." This site provides access to thousands of locally generated weather products and the Net's largest collection of weather links. Here you will find forecast information, weather maps, and a variety of weather data for sites locally and around the world. This site may be a little high-level for first and second graders, but some of the weather images may be of interest. For example, you can view time-lapse images of the weather moving through the Golden Gate into San Francisco Bay on the KPIX-TV weather page.

Let Us Know...

We would like to hear how you are incorporating Internet resources into teaching FOSS. Also Home Pages may come and go. Let us know what you have discovered that works, what doesn't work, new addresses, and any corrections to locations we've mentioned above. You can send the address of other Internet resources you like to FOSS via e-mail to: Sue_Jagoda@maillink.berkeley.edu. After June 1, 1996, contact Sue at her new Internet address: skjagoda@uclink.berkeley.edu



Expanded Service from EBEC

Encyclopædia Britannica Educational Corporation has expanded its capability to include sale of the FOSS kit replacement items. You now have several options for ordering those items required to keep the module kits in tip-top condition.

a) Contact your regional EBEC representative and place your order with him or her.

b) Call EBEC Customer Service (1-800-554-9862) and place your order directly.

Replacement items are available in Module Replacement Kits (all consumable items needed for two additional uses of the kit) and as individual line items.

Contact your regional representative or EBEC customer service to get your copy of the latest FOSS Replacement Parts & Refill Packages Catalog now.

FOSS Replacement Parts & Refill Packages Catalog
Customer Service
Encyclopædia Britannica Educational Corporation
310 South Michigan Avenue
Chicago, IL 60604
1-800-554-9862

Head Bone's Connected...

For several years, we have heard that the Skull Poster in the **Human Body Module** leaves a bit to be desired. Students were not able to see all the bones in the head. We revised the poster this past fall, and the new posters will appear in the kits starting this spring.

If you have a **Human Body** kit, and would like to upgrade your Skull Posters, EBEC will sell you the new posters at cost. All you have to do is call customer service and place your order.

FOSS Institutes

Britannica will host 2-day informational institutes this spring and fall in conjunction with the NSTA National and Regional Conferences. 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 how to network 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, Britannica hosts leadership institutes. These meetings are designed for educators who have adopted FOSS or who are in the more advanced stages of decision making. A lot of time is still spent working with the FOSS materials, but a greater proportion of time is 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 location are listed in the calendar. To secure your spot at the institute of your choice, call, write, or FAX:

Briana Villarrubia
Manager of Professional Relations
310 South Michigan Avenue, 6th floor
Chicago, IL 60604

voice: 1-800-554-9862, ext. 6554
FAX: 312-347-7966

FOSS NSTA Pre-Conference Informational Institutes

March 26-27
(Tues.-Wed.)
Marriott Pavilion Hotel
St. Louis, MO

October 15–16
(Tues.-Wed.)
Phoenix, AZ
Location TBA

October 29–30
(Tues.-Wed.)
Atlanta, GA
Location TBA

November 19–20
(Tues.-Wed.)
Toronto, Ontario
Location TBA

April 1–2, 1997
(Tues.-Wed.)
New Orleans, LA
Location TBA

Other Institutes:

June 20–21, 1996
FOSS Leadership Institute
Lawrence Hall of Science
Berkeley, CA

July 25–26, 1996
FOSS Leadership Institute
EBEC
Chicago, IL

❑ **Yes! I'm interested in attending a FOSS Informational Institute.**
❑ **Yes! I'm interested in attending a FOSS Leadership Institute.**

Please send me registration information for the ______________________ **institute.**
(Date and Location)

Name

School District

Title

Address

City State Zip Daytime Phone

❑ 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. EBEC 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 to FOSS Newsletter, Lawrence Hall of Science, University of California, Berkeley, CA 94720. We'll be waiting to hear from you.

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520.527.8717

FOSS has been adopted by the Canadian provinces of British Columbia and Alberta. Contact:

Ryan Castiller
P.O. Box 18650
Ladner Postal Outlet
Delta, B.C. V4K4V7
phone: 604.946.1241

For information about purchasing FOSS and BSS products or for the phone number of your regional representative, call EBEC Toll Free at: 800.554.9862

For more information about the development of the FOSS program, contact:
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A very special THANK YOU . . . to all the local and national trial teachers who have helped make FOSS such a great success!

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