Satellite Engineers Launch Industry/Elementary Science Partnership Using FOSS
by Arthur Garrison

What’s the difference between a Protist and a Moneran?

When I was asked this question by my wife, a 5th-grade teacher in the Hawthorne (California) School District, as she prepared her lesson plans, I was struck by the fact that, although my job as an engineer designing communication satellites required that I apply science on a daily basis, I probably couldn’t pass 5th-grade science. But more important, I wondered if my wife’s students were really learning much about real science. I decided to look into this further. The year was 1991, and California was still using the old fact-laden textbooks.

That conversation was the start of a several-year odyssey into the world of elementary science education. During the last few years, 20 engineers from TRW Space and Electronics Group (Redondo Beach, California) have spent their lunch hours teaching science at four local elementary schools.

I started by putting together a hands-on lesson about light. It took a week of visits to the children’s section of the local library and late nights putting

Continued on page 2

The Shoreline Approach to FOSS Implementation
by Lynne Bleeker

Shoreline School District is a highly regarded, small district located just north of Seattle, Washington, with eleven elementary schools, two middle schools, and two high schools.

Up until 1995, our elementary science program consisted of kits developed at great expense by teachers from our district. Some of the kits were very good, but many lacked engaging hands-on activities or were inappropriate for the grade levels taught.

Continued on page 4
Satellite Engineers continued

in the garage to debug the activities and structure them so they would lead students to make predictions and discoveries. “How would elementary teachers ever have the background or time to do this on their own?” I wondered. I presented my “masterpiece” to my wife, but as she was reluctant to “free fall” without the security of a familiar textbook, she challenged me to come to her classroom as a visiting “scientist” and try it out myself. I did and was immediately convinced that we were on to something. Not only did the students light up with enthusiasm, but I had a wonderful time and couldn’t wait to return the following week to see how the next lesson turned out.

Soon we decided to recruit additional engineers and see if we could duplicate the process in additional classrooms. With support from TRW management, we attracted ten volunteers from an organization of only 200 engineers, a 5% turnout—much higher than I’d expected. As a group meeting during our lunch hours, we hatched out how we wanted our project to operate.

The principles we formulated then are still guiding us today:

- Concentrate on “infecting” students and teachers with the “joy of science” by using hands-on, inquiry-based techniques led by engineers who enjoy and are fluent with science.
- Don’t shy away from integrating math and meaty science content.
- Form a long-term partnership between a teacher and an engineer so that they both learn from each other and come to rely on each other. The engineers actually lead the lesson, but the teacher interjects often to keep the instructional processes and classroom management on track. Engineers help teachers to increase their own science skills and confidence by encouraging them to do science when the engineer is not in the classroom, knowing that the engineer is only a phone call away.
- Teach at a local, socioeconomically needy school (the Hawthorne schools were a perfect match).
- Work with grades 4, 5, and 6 because students are old enough to interact with the engineers, and their teachers rarely have science training.

How do you teach engineers to teach? (I had learned by videotaping myself in the classroom and having my wife critique the tapes.) We decided to invite local educators to speak and give demonstrations to our group. While the volunteers were being trained, we worked with the school principal to select teachers to participate. Our strategy was to select teachers who weren’t as well prepared to teach science and who would be interested in receiving help. We also looked for teachers with good classroom management skills because we knew that inexperienced engineers might have difficulty communicating with young people.

As a final step in training the engineers, we invited the teachers to our company facility for dinner and a floor show; the aspiring volunteers were each to teach a 15-minute lesson, and the teachers were to be the surrogate students. After each short lesson, we held a group discussion during which we analyzed the lesson delivery. Although the engineers were quite frightened at the start of the evening, by the end, they and the teachers had come to know each other and the barriers were down. We were on our way!

Since that start, we have cautiously expanded the program. There were many things...
we were unsure of at first. For example, we soon discovered that homemade lessons were not able to sustain a team of volunteers. The lessons were difficult and time-consuming to develop, and they were not teacher-friendly which discouraged teachers from doing science on their own. That’s where FOSS came to the rescue.

When I first came across a FOSS Teacher Guide, I immediately realized that my late nights in the garage and trips to the surplus store were over. FOSS captured the spirit and approach to science that the volunteers were eager to impart to students. And the lessons were teacher-friendly so the teachers now felt confident to continue doing science without an engineer present. As a bonus, the scripts led the volunteers steadily through the classroom management and concept development process—something the engineers often found difficult to learn on their own. This proved so useful that we made it mandatory for all beginning volunteers to use FOSS verbatim until their teachers agreed that they had developed enough skill to improvise their own science extensions.

Another reason for our caution was that anyone who knows engineers and elementary teachers knows that they come from two different planets, so the questions we all had were: How well do an engineer and a teacher function together in a classroom? Does a partnership like this really add value? Do the participants get satisfaction?

To find out, after a year of operation, we engineers did a “quality audit” of our program. Through interviews and group discussions with the teachers and principals (our customers) and the engineers (the suppliers), we found that teachers and engineers were generally pleased. Teachers who didn’t have an engineer assigned were clamoring for one, and engineers, who had committed to two class visits per month, were instead often teaching once per week.

We also heard many stories of exciting science being stimulated by the FOSS activities such as the class that used the ceiling lights and wall switch to observe the speed of electricity in the school’s wires, or the class that listened and watched as a basketball was dribbled across the playground to find out whether light or sound traveled faster, or the students who concluded that there must be a magnet in the earth when they saw their floating magnets all point the same direction.

We also found that we needed to tune up some of our processes. First, we learned that the teacher needs to take an active role in helping the engineer, who is inexperienced in communicating with children. The recipe is simple: the teacher must interject whenever necessary during the lesson and show the engineer by example. After the lesson, the teacher must give honest, constructive feedback. Although teachers were concerned about offending their partners, the engineers were unanimously eager to “learn from the pros.”

Second, we found that there is a wide variability in the skills and styles of engineers and teachers. A few partnerships will get into trouble. It is important to monitor this through regular contact with participants and intervene when necessary. Intervention usually consists of classroom observation by the principal or another volunteer, followed by private discussions or coaching and, only rarely, by reassigning the participants. We are also experimenting with a “peer review” system in which engineers occasionally sit in on lessons taught by their peers and exchange impressions afterwards.

Now that the program is running smoothly, our current initiative is to develop a library of science extensions indexed to FOSS modules. Feedback from the engineers has told us that they are eager to go beyond the science content in FOSS which, of course, is targeted to teachers with limited science background. For example, with the **Variables Module**, we’re working to integrate activities on gravity with the pendulum lesson, buoyancy with the lifeboat lesson, and forces, friction and inertia with the airplane lesson. Our ultimate goal is to have the teachers doing FOSS while experienced volunteers lead high science content extensions.
Shoreline Approach continued

Even though the kits covered many of the district “core concepts,” teachers often chose not to subject their students to these kits. In an effort to bolster interest in active science, I and a few other teachers offered summer workshops (optional, but paid) using GEMS activities and Science with Toys program materials. These workshops were well-attended and received enthusiastic response, but we never achieved the district-wide improvement we wanted.

Now we have a brand new K–6 science program. Shoreline School District just completed a highly successful first-year implementation with the FOSS program.

Choosing a Program

During the 1993–94 school year, we got serious about improving our science curriculum. We formed a committee composed of teachers, a few parents, and an administrator. We looked at the national standards for science and spent quite a bit of time in early 1994 with the just-released *Benchmarks for Science* Literacy from Project 2061. We discovered that the National Science Resources Center in Washington, DC, was convening an Elementary Science Leadership Institute in the summer of 1994. We applied, were accepted, and sent a four-person team to the week-long conference in our nation’s capital. I was joined on the DC junket by Al Morasch, Team Director of Instructional Services, Joan Hornig, third-grade teacher, and Lisa MacGeorge, PTA representative (and nurse).

The NSRC conference proved to be a very important event. At the conference we were able to preview three comprehensive elementary science programs: Insights, Science and Technology for Children (STC), and FOSS. We participated in workshops featuring lessons from all three curricula, and we all were very impressed with the FOSS lessons.

Even more important was the opportunity to hear Larry Lowery talk about brain research and its implications for curriculum and instruction. This talk stimulated good discussions and helped us realize that we needed a whole new developmentally appropriate science program, not just minor improvements to our existing kits. The NSRC conference was just what we needed, and it came at exactly the right time in our decision-making process.

Back home we developed a plan and, with committee approval, piloted a selection of kits from FOSS, STC, and Insights during the 1994–95 school year. We wanted to find a program that was excellent, yet easy and enjoyable for teachers to use. Teachers from the committee and some of their friends and partner teachers did the piloting—about 50 teachers in all. We piloted FOSS modules *Landforms, Food and Nutrition, Human Body, Measurement, Animals Two by Two,* and *Paper.*

All of the programs had features we liked, but we made a decision near the end of the year to go with a single program rather than mixing and matching. We felt that it would be easiest for teachers if they had only one teacher guide format to learn. When we set up our checklist of program criteria and graded the programs, FOSS was hands-down the best program in our estimation. We have been delighted with our choice.

Now, as teachers review new materials for adoption in other content areas, the standard statement is something like, “Well, it won’t be as good as the science adoption...”

Inservice

In late summer, each teacher received the teacher guides for the modules identified for his or her grade level. Lead teachers, who were primarily members of the science committee (with a few more added to get representation from every building and every grade level), received an excellent day of inservice training from Sue Jagoda (FOSS earth science specialist) in the summer. In early October, every elementary teacher received a full-day inservice—morning session on the brain research with Larry Lowery, and afternoon module-specific workshops led by the grade-level lead teachers.

We met with the principals. We recommended that they encourage their teachers to teach at least two kits the first year—one in the fall and one in the spring. Teachers were very grateful for the gradual phase-in, but, as we had hoped, many enjoyed teaching FOSS so thoroughly that they ended up teaching all three (or more) modules for their grade level.

The district assumed 40% of the teacher guides. Sue Jagoda (FOSS earth science specialist) handles the rest. With significant district funding and an appropriation from the Elementary Science Center for restocking. Pam has been the single most important factor in the great success of the FOSS adoption, after the materials themselves.

During the first year, we discovered that we needed to increase the number of some kits. The kindergarten *Trees Module* was the most obvious, because the activities start in the fall and can go all year long. This year the kindergarten classes will be planting mulberry trees so that we will have the critically important leaves for the silkworms used in the second-grade *Insects Module.* We ended up ordering more of nearly all of the primary kits (grades 1–5) to meet the demand for the coming year. We thought teachers could share some of the kits between classes, but that turned out to be difficult—wood doesn’t dry fast enough, “mock rocks” are hard to share, plant setups are inaccessible if housed in just one room, and so on. *Solar Energy* was probably our biggest problem. Living in the Pacific Northwest, the sunshine simply isn’t reliable enough to make the kit
practical. We also found that we needed to increase Pam’s contract to 220 days (still 4-hour days) instead of 180, just to get the kits ready to go again in the fall.

Response After the First Year

A survey taken by the lead teachers near the end of the school year showed highly enthusiastic responses to the FOSS program, particularly from the primary teachers. Students love the activities, and teachers feel confident for the first time in their abilities to teach science well. However, some teachers are concerned about the time it takes to prepare the materials and the time the lessons themselves take during the school day. We still need to work on convincing many of them that hands-on science is worth all the extra time and effort it takes to teach.

My middle-school colleagues are very excited about the FOSS program, and are looking forward to a new generation of kids coming to us excited and positive about science and with a common base of experience.

Areas to Work On

I will continue at 40% release to work with teachers to increase their time, materials, and classroom management skills in the science setting. Other areas I will be focusing on in the coming year are:

- helping teachers use the FOSS assessments (especially the hands-on assessments);
- implementing other active assessment strategies such as journaling, projects, etc.;
- enhancing our Quickmail teacher-to-teacher communication system so they can easily share ideas, hints, brainstorm, etc.; and
- developing a high-quality trade book library to help teachers in the area of integrating science with other curriculum areas.

It is my personal hope that these measures will help more teachers see that science experiences can form the core around which other subjects integrate, as opposed to feeling that science “doesn’t fit with what I teach.”

Our goal has been to provide the materials, training, and infrastructure to make it as easy as possible for elementary teachers to teach science well. We feel we are making excellent progress toward that goal. We feel very good about both the selection process and the inservice procedures we went through with the FOSS program, and we feel particularly fortunate to have a large space and an outstanding secretary for kit stocking and delivery.

At the time this article was composed, Lynne Bleeker was a science teacher at Einstein Middle School and K–12 Science Coordinator for the Shoreline School District in Shoreline, Washington. She has since moved on to new experiences in Iowa. For more information about the Shoreline program, you can contact Connie Kelly at 206/361-4372 or 206/361-4411 or via e-mail at c.kelly@pdc.shorelin.wednet.edu.
A new consensus about the nature of learning has emerged. Its formation is stimulated by research in the field that has come to be known as cognitive science. The new conception of learning has a direct bearing on how science, and all other subjects, can be taught most effectively.

The new view supports and provides a clearer understanding of the good things that foster learning and gives ideas for improving or changing those aspects that are ineffective or detrimental to learning. The view supports the intuition of our most thoughtful teachers, and it describes how learners best move from being novices to becoming experts. The view can be expressed quite simply:

Learners construct understanding for themselves;

Understanding is to know relationships;

Knowing relationships depends upon prior knowledge.

Learners do not simply mirror what they are told or what they read. The brain does not store a picture of an event. It does not directly record anything that is shown. What the brain does is store a record of the neural activity that takes place in the sensory and motor systems of an individual as he or she interacts with the environment. Each record is a pattern of connections (dendrites/synapses) among brain cells (neurons) that can be reactivated to recreate the component parts of the experience. The reactivating defines the materials involved in the experience and other characteristics of the event. Thus when you place an image in your mind, you store components of it in many different places and construct pathways among the places so that the entire system of storage and pathways can be fired up as an image when you recall the experience. All conscious and subconscious knowledge and behaviors are constructed as complex systems within your brain.

Constructing Knowledge

In order for the brain to construct knowledge and behaviors, it must take in something that it can construct. The only way the brain takes in data for construction is through the sensory perceptions that enter through the windows of its five senses. Anything that a person does, perceives, thinks, or feels while acting in the world gets processed through the systems. If a student picks up a magnet, brings it toward another object and feels the effect as that object is repelled or attracted by the magnet, that action is processed through the systems in the student’s brain.

Show-and-tell teaching methods (lectures, demonstrations) diminish the number of possible avenues to the brain that can be activated. Enriched environments in which a learner makes inquiries increases the likelihood that something will be constructed.

The brain categorizes non-language sensory perceptions of the world in different places. Shapes are stored in one place, color in another. Movement, sequence, and emotional states are each stored separately. Textures and aromas are stored elsewhere. Aspects of language are also stored in various parts of the brain. Nouns are separated from verbs, and phonemes are separated from words.
As the brain constructs connections among brain cells, the organization of words, objects, events, and relationships are connected in successively interwoven layers of categories. The result is that human knowledge is stored in clusters and organized within the brain into systems that people use to interpret familiar situations and reason about new ones. When language (words and sentence structures) become part of the interweaving, the totality forms the basis for abstract thinking and problem solving.

**Perceiving Relationships**

Knowledge is constructed by the individual through experience, but the quality of the construction depends upon how well the brain organizes and stores the relationships between and among objects in the event—how the arm and hand are positioned to hold the magnet (relationship of the learner to the object), how the magnet can be moved and manipulated (cause-and-effect relationships between the learner’s actions and the observed results), how other objects behave in the presence of the magnet (cause-and-effect relationships in an interaction between objects in the environment).

As further explorations are made with the magnet, the learner tries to link new perceptions to what has already been constructed in the brain’s storage systems. The prior knowledge is used to interpret the new material in terms of established knowledge. Whenever bits of information are isolated from these systems, they are forgotten and become inaccessible to memory.

Constructions in a brain are dependent upon the interest and prior knowledge of the student and the richness of the environment. Enriched environments and quality hands-on experiences contribute significantly to piquing of interests and the linking of perceptions stored within the brain because students can explore, manipulate, test, and make transformations in the objects at hand.

Written formats, such as textbooks, give minimal help because symbols are not reality. They can neither be acted upon nor manipulated. Understanding symbols is dependent upon prior experiential knowledge related to a symbol. The power of printed words rests in the author’s ability to enrich and extend ideas already within a reader. New knowledge gained from reading is actually rearrangements of prior knowledge into new relationships that had not been previously connected. If the reader has little in storage related to the content of what is read, little is gained from reading.

---

**Relationships and Prior Knowledge at Work**

The FOSS Balance and Motion Module provides a good example of how a curriculum can enable learners to construct their own ideas through exploration of relationships among materials (objects) and through the use of reinforcement of prior knowledge.

The module begins when students attempt to balance a cardboard crayfish on the end of a finger. With only a simple challenge and without direct instruction, all children in a short time discover several ways to balance the figure. Imagine the many microperceptions that entered through their sensory windows. Imagine the microactions that the brain processed as it inquired, through hand and arm movements and trial-and-error tests, to locate a place on the figure where it would balance! As the task is carried out, new constructions of relationships among systems in the brain are created and interwoven into the student’s prior knowledge concerning balance.

When clothespins are introduced as variables that can be moved about on the cardboard figure so as to shift its center of gravity, children are challenged to balance the figure in a variety of ways. The sequence of this instruction is important to move students from being novices to becoming experts. Each new challenge does two things. Each provides a rehearsal of prior knowledge constructions, thus making them more permanent. Each provides something new that the brain can assimilate into its prior constructions, thus enriching and extending those constructions.

At first the figure is balanced on its nose so that it stands straight up, then on its nose so that it balances horizontally. Children are challenged to balance it at some of the positions in-between. As the figure is balanced and rebalanced, prior knowledge learned about balancing is reinforced while each new challenge adds a slightly different dimension that the brain incorporates into its prior systems.

In FOSS, we call such subsequent experiences rehearsals. Rehearsals are different from practice. Practice is when someone does the same thing over and over again to improve a performance. Practice has little transferability. Rehearsal is when someone does something again in a

Continued on page 8
similar but not identical way so that what was learned is reinforced while something new is added. New additions increase the likelihood that the knowledge being learned is not learned as something that is task specific. Non-task specific experiences increase the likelihood that the knowledge will be transferable and useful to the individual in a variety of ways. Rehearsals strengthen the connections among the storage areas within brain systems. If connections are not strengthened, they will disengage and fade away. Thus the adage: Use it or lose it!

As the balance activity continues, each subsequent challenge is progressive—new figures (triangles, arcs) help to transfer prior learnings to new situations until students can balance their own pencils and create complex mobiles. It is important to note that each challenge is consistent with a fundamental set of powerful scientific ideas that are reexperienced through activity variations that reinforce prior experiences and add aspects that improve transferability and deepen understandings. And each experience enables students to construct knowledge on their own, in their own way.

With so much explicit knowledge available about how the brain works and with data so clearly supportive of the fact that students construct knowledge for themselves, it is surprising that textbooks, even though they use the language of change, have not changed the way they present content and activities. And it is even more surprising that some educators see no need to change from over-using passive-learner instructional methods, such as show-and-tell teaching, to more thoughtful methods that enable students to construct meaning for themselves through the exploration of relationships and the webbing of those explorations to their prior knowledge.

Teaching and Learning Earth Science

Using the Earth Materials Module

By Professor Jan Woerner

Goals of the Earth Materials Module

The FOSS Earth Materials Module provides students with the opportunity to observe the characteristics of solid Earth materials. The focus is on taking materials apart to find out what they were made of and putting materials together to better understand their properties. Students become engaged in experiences with selected rocks and minerals and in learning and using the vocabulary associated with their properties.

Identifying a mineral or rock is more difficult than identifying other natural objects (trees, flowers, birds, etc.). Mineral properties may vary from specimen to specimen. Mineral specimens are commonly impure, and the presence of a trace of iron, which oxidizes, may change the color significantly. Mineral grains vary in size from submicroscopic to several centimeters. Distinguishing properties may be tough to identify even with a hand lens. Slightly weathered specimens of a mineral may have a lower hardness than that of a fresh specimen, or contain other elements diluting the effect of acid on the mineral.

The correct identification of a rock or mineral is not the goal of the Earth Materials activities for elementary students. Students learn ways to discover differences in rocks and minerals, to identify and test for properties, and to ask questions such as, “What is this rock made of?”

Earth Materials Activities Results

When students are engaged in the Earth Materials activities, they may come up with different results from their neighbors or from what the teacher is expecting due to the inherent differences in the rocks or minerals supplied with the module. Variations from one specimen to another occurs frequently because the scratchability (hardness), grain size, and reaction to acid vary from specimen to specimen. Although the FOSS kit suppliers try to maintain uniform quality and consistency, even rocks or minerals from the same outcrop may give different results, and your set of rocks may contain samples from more than one outcrop.

In some cases, procedures can be modified to produce more definitive results. Tests that give more consistent results can be done, but take a little more effort and precaution before trying them with your students. Consider the following techniques and procedures for extending these Earth Materials activities.
Calcite Quest

If you are not getting good results from the limestone and marble when testing for the presence of calcite, consider using a slightly more concentrated acid, such as a very dilute hydrochloric acid. You can get hydrochloric acid or muriatic acid at chemical or swimming pool supply stores.

**Reminder: This acid needs to be diluted!!!!!**

A mixture of one part acid to four parts water should work on most samples that contain calcite. To prepare the acid, first put on your goggles. Then pour a measured amount of tap water into a large glass beaker or Pyrex cup. Add the measured amount of acid slowly down the side of the container while stirring slowly with a glass rod. Pour the acid in dropper bottles. Use one drop at a time on the rock or mineral specimens.

Another trick you can try which is scratching the surface of the limestone or marble with a nail before testing with vinegar. This produces a fresh surface with which the acid can interact. Make several scratches back and forth, leaving rock powder in the scratch. You should get a reaction with vinegar if calcite is present.

Take It For Granite

Remind students that the tests they are using (e.g. scratchability) are to help identify the minerals in the rock. They need to test each mineral they see in the rock.

If the minerals in the granite are very small, they may be hard to test individually. If students scratch a rock with a paper clip, they may actually scratch several different minerals. They may not be able to tell which mineral is scratched. They may actually remove small grains from the rock without actually scratching any mineral. Having a specimen with large crystals of quartz, mica, and feldspar will help students see that some of those crystals are scratched with the paper clip or nail, but others are not. (An effort is being made to include samples of granitic rocks with very large [coarse] grains in future Earth Materials kits, a type of rock that may be actually what geologists call pegmatitic.)

Even if you use specimens with very small crystals, students can use their hand lens to see if they can observe a scratch anywhere. What they are doing is performing a test, and the results they get are the results they get. If they are not able to tell which mineral, if any, is scratched, that’s OK because it is the inquiry which is the object here. The students should discuss their results, and differing results could be questioned by students or the teacher. Students explain their results and the conclusions they draw from the results as part of their scientific inquiry. These initial explorations into the properties and identities of rocks and minerals may spark a lifelong interest and study of rocks and minerals in your students.

If you would like to learn more about the study of petrology (rocks) and mineralogy (minerals), here are a few references to get you started.


Jan Woerner is a Professor of Science, Mathematics, and Technology Education and earth science specialist at California State University, San Bernardino (jwoerner@wiley.csusb.edu). She just spent her sabbatical with the FOSS staff here at the Lawrence Hall of Science.
LASER: Leadership Academy for Science Education Reform

LASER is a three-year institute for elementary Alameda Unified School District (AUSD) school teachers interested in taking on a leadership role in the area of science and math education. The program began in 1995. The district was chosen for the program based on its prior commitment to science and staff development. Each year’s three-week summer session focuses on learning science content as well as being introduced to instructional practices (such as FOSS). The summer program is followed by eight additional institute days held during the school year where LASER teachers continue their training. LASER teachers also provide training and mentoring to the other teachers during AUSD SIP days.

The program is designed around the research being conducted at Sandia National Laboratories with the goals of increasing scientific knowledge, improving teaching methods, enhancing leadership skills, and fostering school, district, and community involvement in science. The institute is planned and sponsored in partnership with the California Science Implementation Network (CSIN) and FOSS/Lawrence Hall of Science (LHS), and supported by the Department of Energy (DOE), the National Science Foundation, and the participating organizations.

Since the LASER project began, the use of FOSS modules has increased dramatically in Alameda schools. Many of the LASER teachers have now become FOSS leaders as well. The two articles that follow describe how some of the LASER teachers have used and extended FOSS in their classrooms.

For more information about LASER and the Alameda Unified School District, contact Julie Apel at 510-748-4012 or Steven Smith at 510-748-4002.

At Woodstock…
Learning is Electrifying…
By Julie Apel

“All right boys and girls take out your reading books,” I tell my 4th-grade students. Suddenly the bells go off—no it’s not time for recess. Student have just tripped their desk alarms!

When we began reading Dear Mr. Henshaw by Beverly Cleary this year, I had no idea what it would lead to. It all started when we came to the part in the story where Leigh Botts, the main character, decides to build an alarm for his lunch box to deter a “lunch box thief.” My students asked to do the same. During the discussion that followed they realized that they needed to know something about electricity in order to attempt this type of project. Imagine the looks on their faces when they found out we had a FOSS kit sitting right in our classroom called Magnetism and Electricity. My students accepted this invitation to learning with great enthusiasm.

They were very excited as they worked through the lessons and picked up a lot of vocabulary as they described, explained, and wrote about their experiences with magnetic levitation. I think, however, the next part of the unit where they learned how to make an alarm was the best. For that part I collaborated with Judy Hindman, Debbie Sutherland (both K–1 teachers), Arlene Cooper (2–3) and Dawn Watty (5). All were LASER lead teachers at my site. Part of our LASER requirement is to collaborate and team teach a lesson in my classroom. We planned and prepared to team teach the ensuing lessons. During the last hour of the day, Dian Hale came in and took my class so that we could debrief our day.

Our teaching (and learning) day together was an unbelievable experience. I don't know who enjoyed it more, the students or the teachers. The young scientists in my classroom explored, explained, and wrote about circuits, conductors, insulators, and switches. They were then invited to apply what they’d learned to make flashlights and silent alarms for their desks. Afterwards they made posters conveying messages about safety with electricity.

The learning did not stop there. It snowballed. One of my students discovered that if he took one of the tones of my xylophone and hooked it up near the motor which now had a piece of metal taped to it, he could get a ringing sound when the motor spun around and the metal hit the tone. What is amazing to me is that this student is in the Resource program and has a very difficult time writing. He and other students like him were very enthusiastic and motivated to explain and write about their experiences.
Second-grade children at Lum love science. The proof of this can be seen in the total involvement of the children as they work through the activities. It can also be seen when the children bring artifacts and literature supporting the lessons done in class. An example of this occurred when Marcia Hartman introduced the FOSS kit, *Balance and Motion*, to four second-grade classes during demonstration lessons in each of the classrooms. The “intro” activities showed how balance is used in several games and toys, and in particular, the popular balancing bird. For several days after, children from all the classes sought out Mrs. Hartman to show her that they too had a balancing bird.

The two second-grade classes taught by Mrs. Marcia Hartman and Mrs. Mary McGuiness/Mrs. Mary Dierking are exchanging classes twice weekly for art and science. In room 10, Mrs. Hartman teaches science. Art is taught by Mrs. McGuiness in room 9.

Frequently, the art lesson supports the science lesson. The “Design an Insect” art lesson support the FOSS *Insects Module*. The children created, on paper, imaginary “real” and “mutant” insects. The children were able to correctly create and label the parts of their real insects, and they were able to indicate why their mutant creation could not be a real insect. The children wrote stories about their creatures: their habitats, what they ate, whether they were beneficial or pests, and more.

During our science lessons the children willingly participate in discussions and hands-on activities. They have learned there are no dumb questions and that they can find out answers for themselves by doing the hands-on activities. They all love science.

I'm happy to say that this won’t be the only experience my students and I have with team teaching. I’m also working with the lead teachers at Lum School, Cindy Frankel (grade 1), Jack Mathison (4–5). Margery Eriksson (3), and Marcie Harman (2). We will be collaborating and planning to team teach the next few lessons in the *Magnetism and Electricity Module* in my classroom. I cannot say enough about team teaching and collaboration. It’s an incredibly powerful experience. Electromagnetism, here we come!

**It’s All About Balance...**

*By Marcie Hartman*

All the second-grade classrooms at Lum School are actively involved in hands-on, inquiry-based science using FOSS materials. Science is augmented with many ideas and materials, both commercial and teacher made, and is frequently integrated across several curricular areas including math, language arts, music, art, and social studies.
Don’t Let Your Science Fair Get in the Way of Your FOSS Instruction: Participative Science Fairs Keep the Hands-on Principle Working
By Art Lohuis

FOSS extension activities helped us put on an interactive, hands-on science fair, reinforce science lessons, and be cheerleaders for FOSS in our school district.

For five years Nancy Baker and I have team taught a cross-grade-level science program once per week to second- and fifth-grade students in Jackson Hole, Wyoming. We began a pilot project with FOSS in 1994, and later FOSS became our main science curriculum for grades K–5. Our cross-grade cooperative science program serves as an extension of FOSS activities and does not replace the regular FOSS curriculum in our respective classes.

We use fifth-grade students as “science buddies” to help second graders manipulate hands-on materials. We give the older students some responsibility for instruction and explanation. We found over several years that students in both grade levels report that science is more “fun and interesting,” they learn science more thoroughly, they are able to explain with a greater depth of understanding (as measured by embedded and traditional assessment), and, not surprisingly, discipline problems are diminished. From a non-academic perspective, we see friendships and bonding occur between our different age groups.

Starting in April, we teamed second- and fifth-grade students in pairs. They were to choose a hands-on science activity to showcase. Visitors to our cross-grade-level science fair would be invited to join in the learning activity instead of being passive viewers.

In the planning stage, we asked the students to develop a list of 25 or more science discovery activities that were part of our cross-grade-level team teaching during the prior seven months. (This activity gave us some insight about which activities were memorable and which ones students merely tolerated.) Students discussed an activity with their partner and gave us a first, second, and third choice in writing. We admit to matching the activity to the team, taking into account difficulty and student abilities.

For one or two class periods per week over the next six weeks, student pairs researched, illustrated, and practiced their activity, using some of the FOSS bibliography books listed in the Teacher Guide, as well as general science books in our rooms and school library.

Students made a large 22 x 34 inch poster with bold colors, large letters, a big picture to introduce their activity, including a fundamental question that framed their experiment. They practiced with a neighboring team to refine their presentations and to fine tune the activity.

ESL students (about 20% of this year’s class) were encouraged to do their poster in their primary language as well as English. Finding, learning, and using science-specific vocabulary words in their dictionaries or FOSS manuals was part of the project for all students regardless of their primary language. We enlisted the aid of parents and an ESL aide to help with the writing and graphics. Parent volunteers and student interns are an important part of our hands-on science teaching. We made a list of available parents and began to contact them in April for a May “Fair Day.”

After arranging several weeks in advance for gym space, tables, chairs, and times, we put our science fair on the district activity calendar, e-mailed invitations to other classes, and had students write letters to parents, newspapers, and school board members.

On Fair Day, we set up tables in a large horseshoe with our students and their posters located on the outside. Visitors stayed on the inside, moving from booth to booth as the posters or an activity caught their attention. Each class came to the fair at an assigned time and stayed for a half hour. In previous years we found it was easier for our students to present
their activity to a limited grade level and plan for a definite time.

Our fifth and second graders were well-rehearsed and able to assist in the presentation to the visitors. At some stations, fifth- and second-grade students took turns making the initial presentation and helped visitors work with the materials. Parent volunteers were stationed nearby just in case, outfitted with two 18-gallon containers which became the “emergency boxes,” holding extra staplers, duct tape, markers, band aids, and paper towels, as well as backup supplies for the exhibits.

For 2½ hours visiting students made air-powered cars with milk cartons and balloons, blew giant soap bubbles, raised hot air balloons to the gym ceiling, made water tornadoes in soda bottles, constructed geometric shapes with frozen peas and toothpicks, built electromagnets and permanent magnets, investigated local bats and bat boxes, flew different styles of paper aircrafts, and created planetariums in objects as small as film cans and as large as refrigerator boxes.

Many of the visiting students had to be reminded when it was time to leave and were lead away by their teachers. We counted this as a measure of success, along with the feedback we solicited from parents and teachers. Several school board members reported later that the fair was their first experience with “discovery science” activities and that they were favorably impressed by the difficulty of the activities and the depth of student preparation. To some school board members, “FOSS” was a hazy term they had heard about but had never seen at work in the classroom.

To provide follow-up, closure, and review, we held a debriefing with all our students the next day and wrote down their suggestions for improvement on large chart papers taped to the board. Student criticism was insightful and valuable. We will drop some experiments next year and simplify others, refining as we go.

This year marked our fifth annual cross-grade-level science fair. It continues to be an end-of-the-year highlight for our students, their parents, school board members, and visitors. We would like to acknowledge the support of the school board during this project.

This little vignette comes our way from Alice Gilchrist, Science Specialist at the Upper Savannah Science and Math Hub at Lander University in Greenwood, South Carolina. Alice tells us about a fifth-grade boy who attended resource classes three times a day. He was generally not able to demonstrate what the school system might call “smarts,” but he was pretty clever with his hands. It just so happened that FOSS was in use at his school, and his class was doing the Variables Module.

In the first activity, *Swingers*, the students make pendulums and grapple with the variables in a pendulum system that affect the number of swings in a period of time, usually 15 seconds. When they get to the variable of length, all the teams of students prepare pendulums of different lengths, and they count swings for 15 seconds. They then go to a numberline and hang their pendulums on the numbers that represent the number of swings they counted. At this point in the activity it is customary for the students to observe and describe the relationship between the length of the pendulum and the number of swings in 15 seconds—the shorter the string, the greater the number of swings.

For most fifth graders this poses no great challenge, but for some it is a stumbling block. The resource room lad figured out the relationship, but lacked the language facility to express it. Undaunted, he took the problem home, where he had additional resources, and constructed the device illustrated. Now he was able to demonstrate precisely the same relationship that another student might report verbally. The string slides easily through the straw mounted in the can. By putting the pendulum bob in motion (he used a discarded key), and pulling up on the button, the swinging pendulum got progressively shorter and shorter. As the pendulum got shorter, the rate of swinging increased, producing a greater number of swings in a period of time. Voila!! The shorter the string, the greater the number of swings.

Everyone was impressed, and overnight the resource student became the most popular lab partner because of his skill with materials. Not only that, but he was also able to explain to adults how to understand the principle of a pendulum—not always an easy task.

Congratulations for a great invention that we are happy to share with our Variables fans around the country.

---

The Longer the String...

This little vignette comes our way from Alice Gilchrist, Science Specialist at the Upper Savannah Science and Math Hub at Lander University in Greenwood, South Carolina. Alice tells us about a fifth-grade boy who attended resource classes three times a day. He was generally not able to demonstrate what the school system might call “smarts,” but he was pretty clever with his hands. It just so happened that FOSS was in use at his school, and his class was doing the Variables Module.

In the first activity, *Swingers*, the students make pendulums and grapple with the variables in a pendulum system that affect the number of swings in a period of time, usually 15 seconds. When they get to the variable of length, all the teams of students prepare pendulums of different lengths, and they count swings for 15 seconds. They then go to a numberline and hang their pendulums on the numbers that represent the number of swings they counted. At this point in the activity it is customary for the students to observe and describe the relationship between the length of the pendulum and the number of swings in 15 seconds—the shorter the string, the greater the number of swings.

For most fifth graders this poses no great challenge, but for some it is a stumbling block. The resource room lad figured out the relationship, but lacked the language facility to express it. Undaunted, he took the problem home, where he had additional resources, and constructed the device illustrated. Now he was able to demonstrate precisely the same relationship that another student might report verbally. The string slides easily through the straw mounted in the can. By putting the pendulum bob in motion (he used a discarded key), and pulling up on the button, the swinging pendulum got progressively shorter and shorter. As the pendulum got shorter, the rate of swinging increased, producing a greater number of swings in a period of time. Voila!! The shorter the string, the greater the number of swings.

Everyone was impressed, and overnight the resource student became the most popular lab partner because of his skill with materials. Not only that, but he was also able to explain to adults how to understand the principle of a pendulum—not always an easy task.

Congratulations for a great invention that we are happy to share with our Variables fans around the country.
Software and Video Reviews

*Encyclopedia of Science*  
*CD-ROM for Macintosh and Windows*  
DK Publishing, Inc.  
95 Madison Avenue  
New York, NY 10016  
Phone: 212/213-4800 or 1-800-467-9580  
http://www.dk.com/  
**Physical Science Strand**  
The Fall 1996 issue of the FOSS Newsletter included a review of the Dorling-Kindersley book *Dictionary of Science* by Neil Ardley. This issue features the CD-ROM component of everything you wanted to know about science but didn’t know how to ask. For example, do you know why soldiers never march in time over a bridge? How a camel’s feet keep it from sinking into the sand? What gives objects their colors? Using over 600 illustrations and animations, plus audio narration, your students can explore the world of science, meet scientists who have made a contribution to our understanding about how the world works, and gain new technical knowledge of our ever-changing world.  
This CD-ROM includes an online link to “DK Science World.” *Ages ten and up*
TOPO!
CD-ROMs for Macintosh and Windows 3.1, 95, or NT
Wildflower Productions
4104 24th Street, Suite 530
San Francisco, CA 94114
Phone: 415/282-9112
e-mail: TopoSF@aol.com

Landforms Module
Students become familiar with topographic maps in the FOSS Landforms Module. They learn to interpret the maps and to draw profiles that show the side view of features such as Mt. Shasta. Now Wildflower Productions has created a “really cool” CD-ROM with interactive topographic maps that are a great extension to the Landforms Module mapping activities. Wildflower uses digital elevation models (DEMs), a combination of digitized U.S. Geological Survey topographic maps and other digital data, to produce these topographic maps for the computer. At this writing, four CD-ROMs are available: TOPO! San Francisco Bay Area, TOPO! Yosemite, TOPO! Los Angeles and Surrounding Recreational Areas, and TOPO! Sequoia Kings Canyon and Surrounding Wilderness Areas. You can browse, customize and print the U.S.G.S. maps as well as measure distances, build profiles, and search for place names and natural features. The TOPO! CD-ROMs are a particularly useful tool for hikers, mountain bikers, and other outdoor enthusiasts. Check out the TOPO! Web site at http://www.topo.com/ for more information. If you’d like to put in a plug for your local U.S.G.S. topographic quadrangles showing up on a TOPO! CD-ROM, you can contact the company at comments@topo.com or on the Web at http://www.topo.com/notify.html.

The Ultimate 3D Skeleton
CD-ROM for Macintosh and Windows
DK Publishing, Inc.
95 Madison Avenue
New York, NY 10016
Phone: 212/213-4800 or 1-800-467-9580
http://www.dk.com/

Human Body Module
This is another fascinating DK Multimedia CD-ROM that allows your students to take a 3D virtual tour of the human skeleton. They have the chance to get a close-up look at every bone in the human body as well as observe each part of the skeleton in motion. The CD includes over 700 photographic images, 300 movies, and 30,000 words. Each bone can be flipped and rotated as students continue their research of the human skeleton. The audio component allows you to hear the pronunciation of each bone name. A quiz on terminology and function is also included. The disk also allows you to print out both text and images for the bone or part of the skeleton you are viewing.

The Way Things Work 2.0 (with Web Connection)
CD-ROM for Macintosh and Windows
DK Publishing, Inc.
95 Madison Avenue
New York, NY 10016
Phone: 212/213-4800 or 1-800-467-9580
http://www.dk.com/

Ideas and Inventions Module, Models and Designs Module
Based on the popular book by David Macauley, this new version of The Way Things Work CD-ROM includes some new features, such as a tour of the Inventors Workshop by David Macauley and an on-line link to “Mammoth.net” and its Mammoth Inventors’ Club. The disk includes detailed, interactive animations and illustrations of the inner workings of hundreds of machines, explanations of the scientific principles behind each one, hyperlinks from the history of inventions to biographies of the inventors themselves, and much more. The Great Woolly Mammoth is your guide along the way.
General Resources

The following links might be useful for extending activities in several of the FOSS strands. Let us know how you use them!

Access Excellence
http://www.gene.com/ae/
Access Excellence is a national educational program sponsored by Genentech, Inc., a biotechnology industry based in the San Francisco Bay area. Although this site focuses on high school biology teachers, The Resource Center link located here includes a good collection of Web resources related to science and science teaching.

Carol Hurst’s Children’s Literature Site
http://www.carolhurst.com/
This is a collection of reviews of children’s books and ideas of ways to use them in the classroom. You can search the site under the topics of curriculum areas, themes and other subjects, or through the search engine provided. One such search under the Curriculum area of Geography turned up an article about The River Ran Wild by Lynn Cherry (see the FOSS Water Module FACTs) which included references to other books related to rivers and some ideas on how to use them. Other topics included maps and nutrition with their related books.

Kinetic City
http://www.aaas.org/ebv/kcsuper.html
The American Association for the Advancement of Science with a grant from the National Science Foundation has created the Kinetic City radio program, a science adventure show for kids. When you reach the KC website, you connect with the Kinetic City Super Crew, a team of young people who like to solve science mysteries. Students can follow the Crew’s adventures, try hands-on experiments, and more.

Online Connections for FOSS Modules

The Web surf is up as you can see from the following URLs. If you have access to the World Wide Web, the following sites provide a great opportunity to enrich FOSS science activities. Keep in mind that the World Wide Web is a fluctuating environment; links that you discover today may be gone tomorrow.

NOTE: If you really like the site you find, it might be a good idea to print it out or save it as a “source” file. Another possibility is to “whack” a site using an offline browser such as Forefront’s WebWhacker (http://www.ffg.com/) or FreeLoader (http://www.freeloader.net/). This method allows you to then view the site offline (without an Internet connection).
NASA has prepared this site to provide support and services for schools, teachers and students to fully utilize the Internet, and its underlying information technologies, as a basic tool for learning. From this site you can link to online interactive projects, virtual conferences, and other NASA online resources.

Earth Science Strand

Landforms Module

Mt. Shasta Online Images

The U.S.G.S. Cascades Volcano Observatory in Vancouver, Washington maintains a website with up-to-date information about volcanoes in the northwestern United States and around the world. By linking to the address printed here, you connect to a page of images of Mt. Shasta and Shastina that might prove interesting to students working on the Build a Mountain activity.

Finding Your Way With Map and Compass
http://www.usgs.gov/fact-sheets/finding-your-way/finding-your-way.html

A topographic map tells you where things (such as landforms and bodies of water) are and how to get to them. This site includes the online version of a U.S.G.S. fact sheet that provides an introduction to orienteering, i.e. finding your way with a map and compass. This could be a good extension to the Bird’s-Eye View activity, especially if you provide topographic maps of the local area as a resource for your students.

Solar Energy Module

Solar Cooking Archive
http://www.accessone.com/~sbcn/plans.htm#box-style

If your students are interested in other applications of solar energy, this site will introduce them to several plans for constructing solar cookers. It includes everything from easy-to-construct box-style cookers and solar panel cookers (SPC) to parabolic-dish cookers. There are even plans for a bamboo, mud, and dung parabolic cooker!

Sundials
http://www.nbn.com/youcan/interact/sundial.html

The game you find at this site allows you to move the sun around a sundial to observe the relationship between the sun’s position in the sky and the direction the shadow is cast. This site requires at least Netscape 2.0, the Shockwave plug-in, and at least 16MB of RAM.

Solstice
http://solstice.crest.org/

This site is billed as the site for energy efficiency, renewable energy, and sustainable technology information and connections. It is a good start for further research into alternative energy sources, such as solar, wind and geothermal. The site is sponsored by CREST, the Center for Renewable Energy and Sustainable Technology.
**Water Resources Outreach Program/Water Education Posters**
http://h2o.usgs.gov/public/outreach/OutReach.html

The U.S. Geological Survey Water Resources Division has created a series of posters concerning water navigation, wetlands, water use, groundwater, wastewater, and water quality. They have now published these posters and their accompanying activities on the WWW. When you access this site you can print out copies of the poster (or get the address to order your copy) and a variety of student activities relating to the poster topics.

**Life Science Strand**

A number of Web sites relate to several modules in the Life Science strand. You might have older students research these sites for information and images that might interest younger students.

**Biological Resources Division—U.S.G.S.**
http://www.nbs.gov

While the U.S. government was being reinvented during the past few years, the U.S. Biological Resource Service found itself placed under the administration of the U.S. Geological Survey. The BRD mission is to work with others to provide the scientific understanding and technologies needed to support the sound management and conservation of our nation’s biological resources. This page demonstrates the commitment of the BRD to make data and information on the nation’s biological resources more accessible to more people. Of special interest at this site is the Kid’s Corner where you will find an endangered species online coloring book (complete with a Nashville Crayfish) and an online slide show called *Endangered Means There’s Still Time.*

**Bugwatch**
http://bugwatch.com/bugindex.html

A page full of clickable insects is the focus of this Web site. You can link to resources about a variety of six-legged creatures and their relatives, including ants, butterflies, bees, dragonflies, and beetles.

**Electronic Zoo/NetVet**
http://netvet.wustl.edu/e-zoo.htm

You will find information and resources about many different kinds of animals at this site created by the Division of Comparative Medicine at Washington University in St. Louis, Missouri. You can link to a page called “Animals” where you can find links to information, images, sounds, and more for animals including amphibians, birds, cats, cows, dogs, ferrets, fish, and many more. Another NetVet link provides information about caring for pets.

**KidsHealth**
http://kidshealth.org/

KidsHealth is the web site devoted to the health of children and teens. Created by the medical experts at The Nemours Foundation, KidsHealth has loads of accurate, up-to-date information about growth, food and fitness, and more. You’ll find health games, *How The Body Works* animations, the KidsVote health poll, and tons of surprises.

**National Wildlife Federation**
http://www.nwf.org/

This address will take you to the home page of the National Wildlife Federation. From here you can link to a page called “In the Classroom” where you’ll find a number of teaching resources including Animal Tracks On-Line, NatureQuest, Schoolyard Habitats, and NWF for Kids (which includes articles and activities from *Ranger Rick*).

**Steve’s Ant Farm**
http://www.atomicweb.com/antfarm.html

An online ant farm is the highlight of this slightly weird Web site. Besides being able to view realtime images of Steve’s ant farm, there’s a 66k Ant Movie to download and view, and links to more information about ants and other little and large critters. It should make Uncle Milton happy.

*Continued on page 21*
Here are some of the latest books discovered by the FOSS staff that you might be able to use to extend the FOSS reading experience after you have used some of the hands-on activities. We would love to hear how you use these books and others to make literary connections to FOSS for your students.

**Grades K-2**

**Snails**

An introduction to the structure and way of life of some of the 40,000 kinds of snails, with an emphasis on land snails.

**Mirette on the High Wire**

Mirette learns tightrope walking from Monsieur Bellini, a guest in her mother’s boarding house, not knowing that he is a celebrated tightrope artist who has withdrawn from performing because of fear.

**Cricketology (Backyard Buddies)**

Combines a gentle view of insect husbandry with a wonderfully kid-centered batch of questions for them to ask about their crickets and come to know them better.

**Willy and the Cardboard Boxes**

With the help of his imagination and a lot of empty boxes at his father’s office, Willy flies into a colorful world where the boxes become a boat, horse, fire truck, and more. (This book is out of print but may be available at your school or local library.)

**Bridges**

Hand-colored photographs illustrate bridges of many different types, with descriptions of their design and use.

**The Great Kapok Tree: A Tale of the Amazon Rain Forest**

As a man chops away at a great kapok tree in the dense, green Amazon rain forest, the heat and efforts of his work exhaust him until he falls asleep. One by one, the creatures who live in the tree emerge and plead with him not to destroy their world.

**Grades 3-4**

**The Frozen Man**

In this compelling narrative, David Getz explores questions raised by the discovery of the well-preserved body of a frozen man who died more than 5,000 years ago in the Otzal Alps. The bones provided some interesting evidence for scientists to help piece together details about the Frozen Man’s life.
Electricity
Explores the amazing world of electricity from the earliest discoveries to the latest technology that has transformed our lives. Discusses the properties of electricity and describes how it is made and used.

Sound Science
Explores the nature of sound through experiments, riddles, interesting facts, puzzles, and games.

Water Science
Discusses the functions, properties, and vital importance of water in our lives and examines what water hazards we face if we misuse or pollute it. Includes water games and tricks.

Grades 5–6

Egg Drop Blues
Judge is not doing well in science and now his grade depends on the egg-drop competition he’s entered with his twin brother. Will Jury cooperate—and even if he does, will it be enough to earn them a place in the competition? In this third book about the “posse” at Plank Elementary School, Judge tells the story of his struggles with dyslexia.

Machines and How They Work
Defines machines, discusses simple and complex early machines and shows the development of the modern machine through clearly illustrated diagrams and written text.

Teacher Resource

Cool Kids Clubs: Ideas for Science Clubs, Fairs, and More!
Here’s a teacher resource from one of FOSS’s own “teacher/consultant family.” Sylvia gives very detailed information on all the dos and don’ts for starting a science club. You’ll find detailed instructions and forms for budgets, membership, business partnerships, and more.

Maps: Getting from Here to There
Describes many different kinds of maps and explains the methods that map makers have used to convey information, including clear and simple discussions of direction, distance, symbols, topography, latitude, longitude, and scale. Demonstrates how to make your own map.

Sugar Isn’t Everything
A detailed description of juvenile-onset diabetes (Type II) using a fictional form in which eleven-year-old Amy discovers that she has the disease, learns how to treat it and to deal with her anger, and finally accepts that she can live with it.
Online Connections continued

**Physical Science Strand**

**The Little Shop of Physics**

http://129.82.166.181/default.html

The theme of this site from the Physics Department at Colorado State University in Ft. Collins is that you can do interesting science with very simple tools and even while sitting in front of your computer screen. When you open the Online Experiments page you will first see an animated blind-spot activity and links to three other pages: Amazing Physics of Everyday Objects, Experiments for the Total “Mouse Potato,” and Shockwave Experiments (requires the Macromedia Shockwave plug-in). Watch for future developments!

**Scientific Reasoning and Technology Strand**

**Invention Dimension™**


At the end of this long address, you will find an information resource called Invention Dimension, a product of the Lemelson-MIT Prize Program. This resource is for anyone who wants to learn more about American inventors and their discoveries. It includes the results of a survey concerning which inventions Americans could not live without, an Inventor of the Week archive, and an invention hotlist of links to other invention-related Web pages.

**FOSS Book Database (aka FACTs) Available on the World Wide Web**

http://www.lhs.berkeley.edu/Tango/FOSSbooks.qry?function=form

Each FOSS Teacher Guide includes a resource list called the FACTs located after the student sheets. The FACTs include annotated listings for nonfiction and fiction books for students, resource books for teachers, software, multimedia, and video resources that extend the hands-on science activities in each FOSS module. The FACTs are now available on the World Wide Web.

You use a search function to identify the latest resources that have been correlated to the FOSS modules. If you check the Teacher Resource box, only those items intended solely for teacher use will be identified. You can also search only for titles available in Spanish by checking the appropriate box.

The plan is to update the database twice a year, once in early fall and once in the spring. Of course, we’d love to hear about any books or other resources you are using with your students to enhance the FOSS modules. You can send your ideas and suggestions for this database to Sue Jagoda (skjagoda@uclink4.berkeley.edu) at the Lawrence Hall of Science.
At first glance, a FOSS module looks, for the most part, like a box of ordinary, everyday items. A closer look reveals much more. We interviewed John Prescott, the purchasing manager at Delta Education, Inc. to get a better understanding of just what goes into a FOSS module.

*Just how many parts are in the entire FOSS program?*

There are a couple of ways to look at that. There is the number of different items in the program, and there is the total number of those items in the kits. The FOSS program has 550 different items in the database. That means we have to keep an inventory and be ready to fill line-item orders on 550 items at all times.

Then there is the matter of total number of items in the program. That’s harder to say. In the *Landforms Module* alone there are 24 different items in varying quantities, with approximately 390 individual pieces. Multiply that by 26 kits (the number of different FOSS kits now available), and you get some idea of the number of individual parts we assemble.

For an individual teacher or even a school district to have to assemble that many pieces to construct a module seems daunting. I think that’s one of the real advantages of FOSS. All the pieces are already in the module. The teacher doesn’t have to worry about using his or her time or money to purchase the items.

*Many of the parts look like what we get from stationery, drug, or discount stores. Are there really any differences?*

Definitely. Some of the parts are available in many discount, grocery, or office supply stores. However, this can be deceiving. For example, in the past, an inconsistent-sized loop on the binder clip used in the *Models and Designs Module* has hampered the success of an activity. There are many different manufacturers of these types of clips. At first glance they all basically look the same, but you can see the variations on closer inspection. And, because of these variations, many clips will not work properly with the activity.

We worked with our supplier and now we have binder clips made to Delta’s specifications. This way we can guarantee the binder clips purchased from Delta will work well with all FOSS activities requiring that piece of equipment. We’ve done this same thing with other items with manufacturing variations that might affect the activity outcome. By choosing our suppliers carefully and working closely with them and with the FOSS developers, we have achieved the consistency necessary to guarantee success with the FOSS activities.

*What quality control measures has Delta instituted to guard against inconsistencies?*

We have a team of quality inspectors who check each incoming shipment of raw material. They insure consistent quality by verifying each item against the rigid FOSS specifications. We also investigate all complaints of defective materials or material that does not function properly with FOSS activities and work closely with the developers to rectify customer concerns.

We recently have spent quite a good deal of time and money redesigning and manufacturing plastic basins. Although they worked “properly,” we heard complaints that they were not sturdy enough. It was a challenge to increase the thickness of the rim on the basins. It took some time to find a manufacturer who was willing to meet our quality expectations. After continual shopping, we did find a supplier who met the challenge. We feel we now have a very high quality basin.

Delta prides itself on the quality of all our products. This is just an example of the many steps we take with all our goods to make sure they meet our top standards.

With so many kit parts, Delta must have quite a job keeping them all in stock.

I wish we could say that we never had backorders. We do try to keep backorders to a minimum. Our inventory system has some great forecasting features programmed in with necessary lead times on all materials. Unfortunately, we can’t predict the future with 100% accuracy. Sometimes the demand from the field overwhelms us for a short time. But we do know how important it is for our customers to receive their orders promptly, and every aspect of our distribution system from order entry to shipping is organized around our customers’ needs. Our goal is 100% customer satisfaction.
Delta Education will host four 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 is spent at these Institutes 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, and materials maintenance.

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.

Delta Education, Inc.
401 N. Michigan Avenue
Suite 1200
Chicago, IL 60611
voice: 312.840.8582 or 800.374.8593
FAX: 312.755.0690

---

**FOSS Institutes**

- **FOSS NSTA Pre-Convention Informational Institutes**
  - **Oct. 28-29** (Tues.-Wed.) Pittsburgh, PA
  - **Nov. 18-19** (Tues.-Wed.) Denver, CO
  - **Dec. 2-3** (Tues.-Wed.) Nashville, TN
  - **April 14-15, 1998** (Tues.-Wed.) Las Vegas, NV

---

☐ Yes! I'm interested in attending a FOSS Informational Institute.
☐ Yes! I'm interested in attending a FOSS Implementation/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. 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.

I 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. I’m waiting to hear from you.

Sue Jagoda
FOSS Newsletter Editor

Delta FOSS Sales Division

Tom Guetling
National Sales Manager
Chicago, IL
312.840.8584 or 800.374.8593

Cheryl Deese
Marketing Director
Chicago, IL
312.840.8583 or 800.374.8593

Regional Sales Managers

Verne Isbell
Arkadelphia, AR
501.246.2949

Comer Johnson
Folsom, CA
916.983.1702

Jeff Lorton
Minneapolis, MN
612.824.6180

Tom Pence
Oswego, IL
708.951.6049

Dean Taylor
Flagstaff, AZ
520.527.8717

For information about purchasing FOSS products or for the phone number of your regional representative, call Delta Toll Free at:
800.258.1302
Or FAX at:
603.886.4632

Delta Education
5 Hudson Park Drive
Hudson, NH 03051

For information about the development of the FOSS program, contact:
Larry Malone or Linda De Lucchi
FOSS Program
Lawrence Hall of Science
University of California
Berkeley, CA 94720
voice: 510.642.8941
FAX: 510.642.7387
Internet: lmalone@uclink4.berkeley.edu

Delta Education
...because children learn by doing®

PO Box 915
Hudson, NH 03051-0915

A very special THANK YOU . . . to all the local and national trial teachers who have helped make FOSS such a great success!