Students in Pam Lhuillier’s fourth-grade class at Bayview Terrace Elementary School are studying geology. They identify common rock-forming minerals (including quartz, calcite, feldspar, mica, and hornblende) and ore minerals by using a table of diagnostic properties. Students observe samples of granite and volcanic rock with hand lenses. Their hands-on experiences, discussions with partners and table groups, recording of observations in their science notebooks, use of organized data charts, and reinforcement of what they see by reading their FOSS Science Resource books builds knowledge and skills to incorporate what they learn into their speaking and writing. When used this way, FOSS is the embodiment of hands-on integrated learning. Science is used as a content focus to integrate English language arts, mathematics, visual and performing arts, and English language development.

Bayview Terrace and seven other elementary schools in San Diego (Bethune, Dingeman, Emerson Bandini, Johnson, Lindberg Schweitzer, Tierra Santa, and Whitman) have embarked on an exciting journey to use the FOSS program as a focus for their students to better learn science (of course!), but also to improve reading, writing, oral language, and to strengthen and reinforce mathematics. The program is modeled after the highly successful California FOSS Leadership Academy. As a part of the Leadership Academy, school leadership teams spent three years involved in extensive professional development, on-site support, and implementing classroom, site, and district strategies to build science-centered schools; these schools integrated lessons to best teach students English Language Arts, English as a Second Language, and other content matter as it could be appropriately incorporated into FOSS science lessons.

With budget constraints and other institutional limitations, San Diego

Continued on page 2
Unified School District (SDUSD) Science Program Manager, Don Whisman, and FOSS California Professional Development Co-Director, Cathy Klinesteker, outlined essential features for success and leveraged available funding sources to initiate the program. Essential features for success in establishing a science-centered school for this program are as follows.

1. A majority of the teachers at each grade level participate in the project. This means they attend all trainings, participate in on-site planning for the project, work with their colleagues on teaching content and strategies, teach integrated science in their classes for at least the required amount of time, and agree to be part of the change process.

2. District and site administrators agree to provide significant time during the school day for science, 300 minutes per week for grades 3–5 and 150 minutes per week for grades K–2. The real paradigm shift for educators was the idea that even though this time is spent in science content, it is simultaneously enhancing reading, speaking, writing, mathematics, and general cognitive skills by engaging students in highly motivating, hands-on activities. This synergistic use of time has resulted in amazing growth across the curriculum. It doesn’t take time from other subjects, but rather, uses the time more effectively to optimize student learning.

3. Teacher collaboration time. This includes grade-level teacher teams, professional learning communities (PLCs), special education/regular classroom teacher teams, cross grade-level teams, and regular time on staff meeting agendas for check-in to assure that staff-wide issues aren’t impeding progress. This collaboration time continues to evolve with teacher teams based on content, grade level groupings, English language development groupings, students with special needs, and whatever else is defined by the needs and creativity of the teachers in the project. Teachers are finding unique and creative ways of collaborating to best meet the needs of their students, using and addressing the opportunities and limitations of their specific sites.

4. Materials support. This means that every teacher in the project must have access to the FOSS kit they are currently teaching. This seems like an obvious requirement, but with large classes, students with special needs, teachers teaching combination classes with more than one grade level, and other situations that may seem out of the ordinary but are common for teachers in the budget-tight reality of schools, we found it necessary to write this requirement in to assure that teachers have the materials they need. Even though SDUSD has an excellent FOSS inventory, refurbishment system, and distribution mechanism, internal policy sometimes makes it difficult for teachers to get materials, so access to materials had to be addressed.

Don worked with district leaders to provide teacher stipends for summer institute time and substitute costs for school year professional development days. With 164 participants and 8 participating schools, this is no small commitment by the district. Originally, we planned for 6 schools, and about 70 participants. When principals called Don to tell him their teachers were very enthusiastic and really wanted to be included, he successfully advocated
adding two more schools. The FOSS project supports some of Cathy’s time to help Don plan, coordinate, and implement year one of the project, and Delta Education Regional Manager Richard Pacheco is using some of his budget to support consultant time, materials, and miscellaneous costs. Total cost for the project this year is under $150,000, including staffing, materials, and teacher support from SDUSD, FOSS, and Delta Education.

SDUSD has a long history with FOSS and has a cadre of experienced, exemplary classroom teachers and science specialists who serve as professional developers. They provide FOSS workshops for other teachers throughout the district. This team of professional developers is providing leadership for the FOSS Science Academy in their district. Each grade level, K–5, has a professional developer who works repeatedly with those teachers, providing FOSS kit training incorporating science notebooking, technology connections, questioning strategies, and a variety of other specific content and pedagogical skills to support classroom implementation of the program (K, Karal Blankenship; first, Sharon Schmidt; second, Kathryn Schultz; third, Melissa Bird; fourth, Diana Dent; fifth, Lisa Bailey). Another key support person is Mike Senise, SDUSD Technology Department, who is working with teachers on how to best incorporate technology seamlessly into their lessons.

Professional development for this project was consolidated into a three-day summer institute, two project-wide training days during the school year, and three site-specific days at each school facilitated by Don and/or Cathy, with content and process determined by the staff at each school. At the first project-wide training days in October 2012 (separate days for grades K–2 and grades 3–5 to avoid having quite so many substitute teachers on the sites on one single day), every teacher brought student science notebooks, high, medium, and low level, to share with teachers at their grade level to coach each other to better meet their goals of supporting Common Core Standards and science thinking. The fact that every teacher brought notebooks is amazing evidence of the implementation of the project. In the words of Lorelei Olsen, Principal, Tierrasanta Elementary, “I did want to share that I received very positive feedback about the PD from both grade level sets. In addition, they were almost all raving about the power of the science notebooks. Kudos to you and your team. My teachers don’t compliment and rave for nothing!”

But when the rubber hits the road, it’s all about the children. Stories of the children include: “They don’t want to go out for recess when we’re in the middle of science.” “Attendance is better on our big science day. Parents say their kids don’t want to miss science day even when they’re sick.” “____ has never been excited about anything in school, and he loves science!” “They love their notebooks, and I’ve never seen so many of them really writing.”

Great things are happening in these eight schools in San Diego.
FOSSmap Makes Its Debut

By Kathy Long, FOSS Assessment Coordinator, the Lawrence Hall of Science

FOSSmap is a brand-new component of FOSS Third Edition. FOSSmap is a computer program that allows students to take assessments online, allows teachers a way to speed up coding of assessments, and provides a series of reports that help show the progress the class or individual students are making through a module. FOSSmap is a quick and easy tool to use for formative assessment practices and differentiation that helps teachers make sure that each student reaches her or his maximum potential.

FOSSmap has been in development for several years and was part of the Assessing Science Knowledge (ASK) Project that was funded by the National Science Foundation and supported with materials by Delta Education. We have tested and refined the computer program over those years, focusing on the features that would be most helpful to teachers and their students. We interviewed Chris Hwande, a teacher leader in Clayton, Missouri, who used the FOSSmap pilot to maximize science learning and accountability in her district.

Editor’s Note: Chris’s students took the FOSS Second Edition assessments offline. Their data were then entered into the FOSSmap program. FOSSMap has now been released for both FOSS Second and Third Editions. Online assessment is available as part of FOSSmap for FOSS Third Edition.

FOSS: What is your role in the school/district community?

Chris: I am an Elementary Science Specialist in the School District of Clayton. I teach K–5 science at one elementary school, oversee K–5 curriculum district-wide, and provide professional development in science content for other teachers in my district.

FOSS: When did you decide to try using FOSSmap?

Chris: We purchased the FOSS program a few years ago when we needed to revamp our curriculum to better meet the needs of our students. We attended an assessment workshop at an NSTA conference and were introduced to the FOSSmap pilot. As soon as we saw the demonstration, we knew this was the way to go. Nowhere else would we be able to get such a comprehensive tool where we could enter data and get automatically generated reports to help inform our instruction, as well as provide pertinent information to students, staff, and parents.

FOSS: How did you get started using the FOSSmap program?

Chris: I started with just one grade level so that I wouldn’t be overwhelmed. After seeing not only the ease of entering data for each student, but also receiving the information we need to be able to move forward with instruction, I knew we would continue using FOSSmap. The past two years I have used FOSSMap with all of our grade 3–5 students in the units I teach in the science lab.

FOSS: How quickly do you review the assessment data you’ve collected?

Chris: I try to enter the data the same day the students take the assessment so that I can address any concerns in the timeliest manner possible. While it is important to reach all learners at their current level of understanding, this is especially crucial for my English language learners and students with IEPs. It is in these early times of data collection that we can catch those misconceptions that might be arising before students latch on to them.

FOSS: How do you use FOSSmap to plan next instructional steps for students?

Chris: I look for trends across the class or the grade level. If I notice that one class all missed the same question, I know that there was a problem somewhere. I either didn’t spend enough time on the concept, the students didn’t understand the vocabulary used, or something else.

I do not write anything on the I-Checks, nor do I print out any reports to give to the students. Rather, I take the questions that I know we need to look at as a class and focus on those with the students. In some cases, students participate in scientific argumentation about the question at hand, sometimes we physically do an activity that pertains to that question, or we might look at a short video clip about the concept. After asking students to share their thoughts and discussing them as a class, I ask the students to go back and look at the answer to see if they want to change it, or add to it to make a stronger case. They know that the I-Checks are a part of their learning and that at times, as we gather more evidence, our minds might change about an answer in as little as a few, short minutes.

FOSS: Do you use FOSSmap at the district level?

Chris: At the district level we use the data in our science professional learning community to compare data across schools. This allows us to have focused conversations on what we can do to support our students.

FOSS: How has using FOSSmap changed your instruction?

Chris: FOSSmap has created in me an entirely different mindset about teaching science. I used to focus on my teaching; that is, I made all the right plans, set up the activities, said all the right words, etc., but still wasn’t always happy with the end result. FOSSmap has flipped a switch in me so that my focus is no longer on my teaching, but on the students’ learning. At the end of the day that’s the most important part—what did the students learn?

FOSS: How has using FOSSmap changed your understanding of how students learn?

Chris: I think FOSSmap has strengthened my idea that student learning is always on a spectrum. There’s an end goal that we want our students to reach, but there is always a journey in getting there. Using FOSSmap shows me which students are “quick learners” that grasp new concepts and vocabulary quickly, and which students may need more learning experiences to solidify their understanding.
FOSS: What else would you like to share about your experience with FOSSmap?

Chris: As the Elementary Science Specialist, I enter in data for two-thirds of the science that happens at my school. The classroom teachers with whom I work are responsible for teaching the other one-third of their students’ science. The teachers have seen me use FOSSmap for several units over a couple of years and have asked questions throughout that time. I am happy to say that this year all of the grade 3–5 teachers are using FOSSmap and the “Student Assessment Report” as a way to communicate effectively with parents about the posttest. Some of our teachers have moved beyond that into using it for all of their data collection. With such a comprehensive tool at our fingertips, I anticipate that all teachers will be using this amazing tool within just a few years. 🌞

School-Wide Commitment to Science: How Students Play a Crucial Role

By April Holton and Kristen Moorhead, FOSS Consultants

“Look! The science ladies are here!” is a common greeting that we hear upon entering Kit Carson College Preparatory Academy of Creative Arts and Technology. This is our second year of a focused FOSS professional development program at Carson, located in downtown Las Vegas in Clark County School District. As we start our consultant day working with the teachers, we are excited to see that the students are the ones benefiting from the continued professional development and support. The analogy of science leadership as a parade presented by Larry Malone in the Fall 2012 FOSS Newsletter exemplifies the work and commitment of Clark County School District K–5 science coordinators, FOSS consultants, the Kit Carson principal, the International Baccalaureate (IB) coordinator, teachers, and students. We are all marching forward to the tune of increased science conceptual understanding, increased abilities to use scientific practices, and a shared belief that science is important. In the words of Larry Malone, “The potential for reform is much greater than a simple transformation of student academic performance. The culture of the classroom can be transformed into a community of learners, which is extremely rewarding for teachers and students alike” (Fall 2012 FOSS Newsletter).

This science leadership parade began in the 2011–12 school year and continues to grow as Cynthia Marlowe, the principal, leads the parade with her unwavering commitment to a rich and rigorous school curriculum for all students. According to Ms. Marlowe:

Usually, most schools that are labeled ‘needs improvement’ choose to focus on literacy and math and leave little or no time for science. I disagree; I believe that all students should be exposed to science. Many students come alive during science instruction because they are given the opportunity to ask questions, explore, observe, participate in hands-on activities and find the answer to their questions through observing and experimenting. I believe science should begin in Pre–K. Waiting until middle school is too late. I am proud that my teachers are excited about science instruction. Their excitement and knowledge keeps our students motivated and they too enjoy science instruction.

A second grader retrieving her balloon rocket, from the FOSS Air and Weather Module

Even though the parade route and many of the adults in the parade may change from year to year, the students are marching on as their achievements and understandings cause them to drive the sophistication of the parade. A key aspect of this analogy is that the parade is no longer staged for students, but instead, students are engaged in every aspect of the learning and are now leading the parade. This became clear when we began the 2012–13 school year; we were blown away by students’ science talking, thinking, and writing just three weeks into the school year. We observed students in grades 1–5 writing in science notebooks as if it was business as usual. We realized the true magnitude of student leadership when we learned that 61% of the teachers were new to the school. We knew there would be some changes in teaching staff because Carson is in the process of becoming an IB school and increasing the student body by 39%.

Continued on page 10
How McMinnville School District Provides Science-Focused, Field- and Industry-Based Teaching and Learning for All Elementary Students

By Michelle Barff, FOSS Science Secretary, McMinnville School District and Erica Beck Spencer, FOSS Curriculum Specialist

"The science experiences are an amazing opportunity for students to apply the knowledge and information they are receiving in the classroom to the real world," Third-Grade Teacher

Like many districts across the country, the McMinnville School District, located in the northwest corner of Oregon, is busy teaching FOSS science regularly. In an era of testing, testing, testing, and reading, reading, reading, this alone is something to be proud of. In addition to great science teaching, classroom teachers are supplementing the program by providing students with field- and industry-based teaching and learning that connects to and extends the science content learned in the classroom. This district-wide initiative began in 2008 when Stephanie Legard, a fifth-grade teacher and teacher on special assignment (TOSA), worked to develop a science activity at Miller Woods that would extend the learning in second-grade classrooms. Stephanie consulted with a small group of second-grade teachers and with Jared Larson, a science department chair, to make the field trip activity as strong as possible.
Miller Woods is located a few miles west of McMinnville in the coastal foothills. It is a beautiful 130-acre nature preserve with grass and pasture land, varying ages of diverse forested land, old growth trees, ponds and streams, hiking trails, and native plants. Miller Woods becomes a big, outdoor classroom where students from the six local elementary schools learn about insects, soils, water, wildlife, climate, and forestry. Miller Woods is a perfect destination for field-based teaching and learning. In the school district’s “backyard,” it provides a place to study and explore nature and to create a new generation of caring stewards for our natural resources. Every second grader in the district now gets to go to this incredible natural resource to conduct observations and hunt insects in three habitats: ponds, grasslands, and woodlands. The science experience lasts about three hours from the time students leave school until the time they return, but the lessons are called upon again and again throughout the year.

The district is supported by the McMinnville Education Foundation (MEF), a volunteer-driven, nonprofit organization that raises funds from parents, businesses, and other interested citizens to support education endeavors and programs. One of the goals of the foundation is to provide equity throughout the district by funding field- and industry-based teaching and learning in science and STEM for all grades, thereby making sure all students have access to these wonderful opportunities to enhance what they learn in the classroom. The program is titled the Elementary Science Experience. The McMinnville Education Foundation, along with district industry partners, Evergreen Aviation and Space Museum, McMinnville Water and Light, and the Yamhill County Soil and Water Conservation District, are instrumental in supporting the Elementary Science Experience and providing hands-on learning activities and transportation for students.

McMinnville School District has about three thousand elementary students attending the six elementary schools. Two thirds of students receive free and reduced lunch. Despite being a high-poverty school district, three of the district’s elementary schools have been designated model schools: among the most exemplary schools in the state, as designated by the Oregon Department of Education. At the elementary level, Oregon Department of Education rankings of every school in the state focus on four areas: 1) academic achievement, 2) academic growth, 3) subgroup achievement, and 4) subgroup growth (individual student gains over two–four years for historically underserved subgroups).¹ Dr. Maryalice Russell, McMinnville School District’s superintendent since 2002, and recently named 2013 Superintendent of the Year by the Oregon Association of School Executives, is the visionary behind the schools’ achievements and the opportunities the district provides for students in math and science.

Taking students on field trips is not unique. Many teachers across the country provide these opportunities for students, despite the increased workload needed to organize an off-site learning experience. What is unique in McMinnville School District is the intentional connection between field- and industry-based teaching and learning and the indoor science program experienced by all students across the district and at all grade levels. Connecting authentic applications of learning in science to students’ interests, such as that which occurs in the Elementary Science Experience program, is also an effective teaching strategy for solidifying student learning. Texas A&M University, in conjunction with the Texas Education Agency, conducted a meta-analysis of research about the most effective teaching strategies to define how to best improve student learning, and researchers ranked strategies in order of effectiveness. The number one ranked strategy was called Enhanced Context Strategies, which is as follows: “Relating learning to students’ previous experiences, knowledge or interests, e.g. using problem based learning, taking field trips, using the schoolyard for lessons, encouraging reflection.”²

Another advocate for the program is Tony Vicknair, District Director of Secondary Programs. Tony develops programs that activate excitement in students about learning and about the future. He believes that the Elementary Science Experience program engages elementary and middle school students who then look forward to learning science in high school. The Science Experiences act as a “feeder to career pathways at the high school level.” For example, a student may become inspired by the FOSS Insects, Structures of Life, or Environments Modules in elementary school, and when they reach McMinnville High School, they may choose Natural Resources for their career pathway. If so, they would then have the opportunity to mentor students on the Elementary Science Experience to Miller Woods. Another elementary student may be more engaged with the Models and Designs, Magnetism and Electricity, or Levers and Pulleys Modules. This student would more likely feed directly into middle school STEM programs, eventually matriculating on to the Engineering & Aerospace Science Academy (EASA), a grade 9–12 McMinnville High School Career Pathway program located at Evergreen Space Museum. These students would then volunteer with fifth graders during their industry-based STEM experience at Evergreen. FOSS plays a big hand in getting students excited about science and engineering. Students are introduced to FOSS kits beginning in kindergarten, and science remains a

Continued on page 8
McMinnville continued

core component of their schooling until graduation and beyond. Thus, it is the district’s goal to develop two field- and industry-based science experiences per year for each elementary grade level.

Creating great science experiences for K–12 students in the district is a joint undertaking. Tony works with Jared Larson, the Science Chair and Instructional Coach, throughout the year to ensure that field-based teaching and learning is aligned with grade-level standards and to make the experiences manageable. Classroom teachers help build and design the stations for the experiences. Principals then map out schedules, which also includes working with the schedules of high school student mentors who are in career pathways. Jared points out that, “We are unique because all six elementary schools in our district are getting the same field-based science experiences. It doesn’t matter if one school is more affluent than another, has a stronger PTA than another, and is bigger or smaller. The experiences are equal.”

The investigations students do on their science experience vary. Fifth graders will extend the Levers and Pulleys Module by using spring scales, weights, and ramps for several experiments involving skateboards. For example, one experiment done with skateboards is to test the direction of motion and the force of friction. This is done by using a spring scale to measure the amount of friction force acting on a skateboard with wheels and a skateboard without wheels. Weight is added to the deck of the skateboards and students then write down their observations. Another experiment done with skateboards is to investigate how the different types of footwear impact the amount of friction between the foot and the floor. Students measure how far they can go with one push while wearing their shoes and then they measure how far they can go wearing just a sock on their pushing feet. These first-hand experiences highlighting the importance of friction are unforgettable.

Fourth graders conduct a soil study at Miller Woods in which they apply learning from the Earth Materials Module. They get an opportunity to study macro invertebrates and then work on a service-learning project to build birdhouses for the songbirds that live in the fields surrounded by the woods. All of this provides a new context under which to consider their studies on food chains and food webs.

Third graders study the Water Module and then go to the Norman Haskins Water Treatment Facility. They hike through the forest to one of the local reservoirs to see where their drinking water comes from, and they build a plumbing system that models sending water from a treatment plant to their home. Lessons also include building water filters to filter muddy water and experiments that show how gravity effects water flow.

Second graders travel about ten minutes to Miller Woods after studying the Insects Module in the spring. Students learn what it means to be an entomologist. They study insects at the pond, in the fields, and in a wooded area. Second graders write their observations and insect
identifications in their “Insecta Inspecta” journals. Some students are so enthusiastic, they have to be reminded that they cannot pick up every insect they see.

First graders enjoy an engineering science experience at Evergreen Museum during the month of May. This is a fairly new science experience for the district and it is continuing to develop and be fine-tuned so that it matches the science standards. Last year, students studied how an airplane wing has “lift.”

Additionally, the district is working on a brand new field trip for kindergartners.

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Module</th>
<th>Site</th>
<th>How is the FOSS module being incorporated?</th>
<th>Financial and Other Support from Community and State</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Animals Two by Two, Trees</td>
<td>Wetland Park—McMinnville Parks and Recreation</td>
<td>Animals Two by Two—worm movement relay game; water snail and tadpole observation Trees—woodland hike with identification; leaf rubbings</td>
<td>McMinnville Education Foundation provides buses and substitutes as needed.</td>
</tr>
<tr>
<td>1st Grade</td>
<td>Air and Weather</td>
<td>Evergreen Aviation and Space Museum</td>
<td>Students make paper airplanes at the museum after learning about the lift of an airplane’s wing. They study clouds and air movement in the classroom.</td>
<td>McMinnville Kiwanis Club completely supports this first-grade field trip.</td>
</tr>
<tr>
<td>2nd Grade</td>
<td>Insects</td>
<td>Miller Woods</td>
<td>Insect hunt and observation in ponds, grasslands, and woodlands</td>
<td>McMinnville Education Foundation provides buses and substitutes as needed. Miller Woods provides the site for second-grade field trips. Career Pathway high school mentors are on hand for guiding stations; community volunteers also assist.</td>
</tr>
<tr>
<td>3rd Grade</td>
<td>Water</td>
<td>Norman Scott Water Treatment Plant</td>
<td>Discuss water cycle and look at examples while hiking to reservoir; engineer gravity fed plumbing system</td>
<td>McMinnville Water and Light completely supports this third-grade field trip.</td>
</tr>
<tr>
<td>4th Grade</td>
<td>Earth Materials, Food Chains and Webs (DSM)</td>
<td>Miller Woods</td>
<td>Earth Materials—At Miller Woods, complete journal soil pages based on Earth Materials Food Chains and Webs—observe macro invertebrates, plants, birds and their interactions with the environment; Service Project: building bird houses</td>
<td>McMinnville Education Foundation provides buses and substitutes as needed. Miller Woods provides the site for fourth-grade field trips.</td>
</tr>
<tr>
<td>5th Grade</td>
<td>Levers and Pulleys</td>
<td>Evergreen Aviation and Space Museum</td>
<td>Direction of motion and force of friction using skateboards and spring scales, manipulating surface contact, bearings, and ramps</td>
<td>McMinnville Education Foundation provides buses and substitutes as needed. EASA provides classrooms for Engineer Career Pathway students to host fifth-grade classes.</td>
</tr>
<tr>
<td>Middle School</td>
<td>Landforms</td>
<td>Metsker Park</td>
<td>After studying landforms &amp; erosion on Mt. Shasta and Mt. Hood (local); go on a forest hike to document erosion; stream table investigation</td>
<td>Yamhill County Parks—McMinnville Education Foundation funds this field trip.</td>
</tr>
</tbody>
</table>

Note: Oregon Department of Education STEM Grant, along with the McMinnville Education Foundation, Miller Woods, Norman Scott Water Treatment Plant, McMinnville Kiwanis Club, Evergreen Aviation and Space Museum, and the Yamhill County Soil and Water Conservation District have all helped to support the creation of these field trips.

Last year they successfully piloted an outdoor pond study unit along with the Animals Two by Two Module. Many of the youngest students have never had a “nature” experience. They were so excited about being able to see live specimens such as snakes, beetles, salamanders, centipedes, and caterpillars. It was a great opportunity for them to be able to see which critters were the “same” and which were “different.” Jared has met with a few kindergarten teachers, and they are organizing the pilot program into a field-based experience for all kindergartens to enjoy in the spring of 2013.

Extending FOSS modules can still happen even if you do not have funding for field- and industry-based experiences. Are you studying the Insects Module? Conduct an insect search right in your schoolyard. Is your class investigating the Levers and Pulleys Module? Use some simple machines in the schoolyard. What about the Landforms Module? Search for examples of erosion and deposition after a rainstorm. Can’t find any? Try to create some by pouring water on the earth. The Science in the Schoolyard Guides™ found on FOSSweb highlight places in the FOSS program where you and your students can go outside to apply the concepts studied in the classroom to the schoolyard. Certainly, if you would also like to engage students in field-based learning, consider starting the way McMinnville did—with one teacher, one group of students, and a great site. Invite administrators in your district to observe the impact on students and try to grow the program.

The FOSS team commends the McMinnville School District for this exciting work! 🌈

School-Wide Commitment to Science continued

Just imagine if, in your school, over half of the teachers were new to the school. What would you expect to see in the third week of school? We expected that we would need to go back to year-one learning for all of the teachers and students, but instead we found what we considered amazing. In the book *The New Meaning of Educational Change*, Michael Fullan states, “meaning fuels motivation” (2007, p. 39). We saw this firsthand as the project took on a life of its own. The enthusiasm for teaching and learning science was contagious and seemed to just “rub off” on the new teachers and students in the school. Not only were students ready to do science, but in the student work samples examined across the grade levels on the 13th day of the new school year, we recognized that students were applying their learning from the previous school year to the current year. Students were developing a conceptual framework of the *structure of matter* across grade levels as evidenced by the writing in their science notebooks.

Because 100% of teachers and students during year one of the professional development program were engaged in ongoing science learning aimed at developing shared meaning about the content and pedagogy of the FOSS program, a commitment to science emerged that sustained science learning at Carson as we began year two of the professional development program.

Our first indicator that something special was going on at Carson was when, in September 2012, we engaged teachers in professional development related to how to support students in constructing scientific explanations. We were able to focus on the sense-making aspect of investigative science because teachers and students began the year knowing that as scientists, their role was to investigate science ideas through active investigation, to observe carefully and record observations, and to critically examine the observations of others in order to understand important science concepts.

Our second indicator that something special was happening at Carson was evidence from student science talk and notebooks that students were applying knowledge from one context to another. For example, one third grader recorded *untransparent* and *inflexible* as properties of a lima bean seed. This student learned the words *transparent* and *flexible* when studying the properties of solids in second grade. Could this be evidence that the student is applying previous understandings and vocabulary related to the properties of solids from the **FOSS Solids and Liquids Module** to her observations of a lima beans seed in the **FOSS Structures of Life Module**? It is possible, and it is so exciting! Again, although not perfectly executed, the attempt can help us understand how to help students connect their learning related to a core science idea from one year to the next, which is only possible if every student has the opportunity every year to do science.

Not only did we see these exciting results through formatively assessing notebooks in the fall of 2012, but we also saw an increase in the state assessment results after one year of professional development. The results of the Nevada State Criterion Referenced Test (CRT) for science at the fifth-grade level showed us that 56% of all fifth graders in 2012 met or exceeded the science standards as compared to 40% of all fifth graders in 2011. After digging a little deeper, we found gains among student groups that are traditionally underrepresented in the sciences. For example, 46% of students who qualify for free or reduced lunch met or exceeded the science standards compared to 36% the previous year. Additionally, 35% of African-American students met or exceeded the science standards, as compared to 20% in 2011. One might wonder if taking more time for teaching science might negatively affect reading scores. In this case, fifth-grade students showed improvements in reading as well. Among fifth-grade students, 75% met or exceeded the standards in reading in 2012, as compared to 67% of the fourth graders in 2011. Keeping in mind that this is the first year of this project, these are very impressive results.
So how did all of this happen? This project began as a result of a series of serendipitous events. In July 2011, Ms. Marlowe approached the Clark County School District Coordinator for K–5 Science, Eileen Gilligan, to find out what FOSS professional development opportunities might be available to her school. That same week, Richard Pacheco, the Delta Education Regional Manager, contacted Eileen to find out if there might be a school in the district interested in committing to an intensive FOSS professional development program designed to increase science student learning at grades K–5. Thus, an opportunity for science teaching and learning was born.

As teachers embarked on this journey, their starting points could be categorized as brand new to teaching FOSS, experience teaching parts of FOSS without professional development, or experience teaching FOSS with professional development. Based on an understanding of where teachers were in their science teaching practices, three professional development goals were determined: 1) increasing teacher science content and pedagogical knowledge through doing investigations and building explanations; 2) increasing use of science notebooks as a vehicle for student talk, writing and vocabulary development; and 3) increasing use of formative assessment using the Reflective Assessment Technique (Spring 2011 FOSS Newsletter; Kennedy, Long and Camins, 2009).

To reach these goals, the FOSS Consultant team, Virginia Hernandez, April Holton, Kristen Moorhead, and Shari Stagner, developed a professional development program based on the professional development goals and the principles of effective professional development described in Designing Professional Development for Teachers of Science and Mathematics (Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2003). Teachers at every grade level had the opportunity to work with one of the FOSS consultants nine times during the school year to build their content and pedagogical knowledge, examine their practices critically by using FOSS learning approaches as adult learners, and to study student thinking and learning collaboratively in a real-time classroom using FOSS learning approaches.

What effect did this professional development program have on teachers? One teacher stated, “There are so many connections with vocabulary to other areas of the curriculum and students are building their vocabulary. Students are building curiosity and thinking skills. I am amazed by the questions students ask about the world around them which has helped them build background for the future. I enjoy teaching [science]!” Administrators at the school and district level are also partners in observing and evaluating the professional development throughout the year. This ensured that the FOSS professional development was linked to the school goal of using an inquiry teaching approach throughout the school day aligned with the IB philosophy.

As a result of opportunities for teachers and administrators to develop shared meaning of science content and pedagogy through implementation of FOSS, students were involved in constructing their own meaning of science, therefore fueling their motivation as well as motivation for the whole system. So perhaps it is this shared meaning that provides energy to fuel a leadership parade and the commitment of the school community. Furthermore, we recognize that “Meaning must be accomplished at every level of the system, but if it is not done at the level of the student, for the vast majority of students, all is lost” (Fullan, p. 187, 2007). We have witnessed this meaning-making at every level at Carson, and the result has been the recognizable passion for teaching and learning science. We can’t wait to see where this parade leads as we continue to work with teachers at Carson. Let the parade march on!

References
I recently read a scholarly article authored by Drs. Richard Duschl and Richard Grandy: “Two Views About Explicitly Teaching Nature of Science” (2012). The thesis of the article delves deeply into issues concerning engaging students in one of the deep currents in the field of science; the nature of science. I first of all had to reacquaint myself with the concept of nature of science, and then to consider the authors’ positions regarding the teaching of nature of science. And finally I had to determine how FOSS might align with their positions.

Nature of science is the pulse and imagination of science—perhaps the soul of the scientific enterprise. The idea of nature of science is abstract and philosophical. It deals simultaneously with all levels of scientific thought. Nature of science embraces what we know about the natural world (content), how we come to know it (process [practice]), and why we believe that knowledge to be valid and reliable (epistemology). These three factors involve cognitive, social, and philosophical engagement.

These considerations run headlong into another set of teaching/learning issues with which I have grappled for some time. Instruction is intended to produce learning. Often an instructional episode is designed to achieve a particular (limited) bit of learning. This is laudable, but hardly sufficient as an ultimate goal. For instance, students can easily learn that air can be warmed (its temperature raised) by being subjected to a source of energy. When a bit of learning is associated with other bits of learning those bits can be cobbled (constructed) into something that has elevated power and meaning. The product of cognitive cobbling is knowledge.

For example, when the idea that air can be heated is placed in proximity to the ideas of a) sunlight is a source of energy, b) water can be warmed by exposure to solar energy, and c) energy can transfer between or through samples of matter when molecules collide, students can construct the concept that Earth’s atmosphere is heated and cooled as a result of everyday physical interactions in the environment. Knowledge is a major goal of science instruction. And when students are able to apply their knowledge using the lenses and tools of nature of science, knowledge can be advanced to the next level of cognitive fruition: understanding. Knowledge of the physics of atmospheric energy exchange, plus critical scrutiny and evidence development, can guide the learner to an understanding of global climate change, one of the really big points of contact at the interface between science and societal issues.

The book Taking Science to School (National Research Council, 2007) reports on contemporary thinking about the design and enactment of school science teaching and learning. The emerging consensus concerning effective science instruction points toward the essential marriage between science knowledge and science practices (inquiry science) with consideration given to knowledge construction derived from epistemology and social interactions (nature of science). And refined knowledge of teaching/learning and the practices of science have informed our advanced understanding of the nature of science. This, I’m sure, sounds unnecessarily circular. But, engagement in inquiry activities fosters nature of science awareness; knowledge of nature of science accrues from engagement in authentic, robust inquiry activity. Understanding the nature of science appears to depend on 1) having meaningful experiences engaging in appropriate practices embedded in informative environments, 2) developing coherent ways of representing and communicating the science concepts and propositions (models) extracted from experience, and 3) developing the reflective rationale and arguments that refute or validate and build credibility for the explanatory conclusions reached.

To achieve this higher-order understanding of science, the authors of Taking Science to School recommend longer thoughtfully designed teaching sequences (learning progressions) devoted to fundamentally important topics. The emphasis on learning progressions suggests a shift away from what we want students to know (facts, skills) to a focus on how students come to acquire scientific knowledge, and why they should believe what they know is worthy when compared to alternative propositions. Issues of how and why lead directly to science teaching and learning that is significantly grounded in the development of evidence.

The development of evidence is an issue in itself. Some people assert that data are evidence. Observation produces data. Data are position neutral. Data must be acted on and contextualized by a human mind before they can be advanced to the status of evidence. Evidence does have a position. Evidence proclaims either yea or nay; evidence has a proposition imbedded in it construction. A scientist who conducts an experiment to intentionally acquire evidence is not acting in good faith. If the investigator has a preconceived notion of an outcome he or she is striving for, bias has been introduced into the investigation, making objectivity much harder to achieve.
Transforming observation into evidence is a critical part of the construction and refinement of knowledge. Often such knowledge construction is a collaborative social endeavor. The processing of scientific observation into evidence to define and refine models and other explanatory tools is a key component of the nature of science. The process of developing logical evidence to defend and validate summary propositions is at the heart of the nature of science. The nature of science is alive in this scientific inquiry arena—the confluence of cognitive activity, engagement in science practice, and participation in the social milieu created by the interaction of multiple minds and experiences.

The scientific knowledge we strive for in FOSS is difficult to describe in the FOSS Investigation Guides. We want our students to have familiarity with the inventory of objects and materials in the world and to have emerging knowledge of the principles and concepts that provide systematic structure and organization to those objects and materials. That part is fairly straightforward. And now it is clear to me that we want students and their teachers to start a lifelong journey on the path marked “nature of science.” Along that path, FOSS students will be expected to construct logical models to explain natural phenomena, be encouraged to question their own evidence and conclusions, and have at least a few fleeting opportunities to assess and evaluate their beliefs about the trustworthiness of their own thinking. If nothing else, the nature of science is spiced liberally with challenge and skepticism. Welcome to the path less traveled.

Firsthand Experiences in National Parks through Distance Learning
By Susan Kaschner Jagoda

One of my first memories of anything geological is of a walking trip to a nearby gravel pit when I was in sixth grade in Wacousta, Michigan. I still have vivid memories of picking up an eye-catching rock and discovering the outline of a seashell. It wasn’t until I took my first geology class in college that I learned that one could actually have a career studying rocks and fossils. The instructors at Lansing Community College, Rod Cranson and Dick Yarger, provided opportunities to get out into the field for up-close and personal experiences with geology and paleontology. I soon changed my focus from a career in library science to one in the earth sciences.

My firsthand experiences in geology inspired our efforts at FOSS to provide professional development for the FOSS Earth History Course on-site at Grand Canyon. Informal feedback from participants in the workshops suggests that the teachers went back into the classroom with more enthusiasm and personal knowledge of the park and its geology. One teacher related this experience to me after a few months back in the classroom—when presenting some aspect of Grand Canyon while teaching Earth History a student asked, “What was it like when you were there?” The teacher’s firsthand experience brought this student a little closer to the realization that the Grand Canyon was a real place, one that he or she might actually visit sometime in the future. The teacher’s experience connected the students and what they were learning to a real place!

Working in the earth sciences has provided me with a number of memorable experiences—hiking the Kaibab and Hermit Trails at Grand Canyon, carefully trekking across the crusty surface of lava flows on the Big Island of Hawaii, searching for dinosaur eggs at Egg Mountain in Montana, and more. The common denominator in all of these adventures is that they were all firsthand, direct encounters with the natural world. That’s what made them memorable.

So, here’s our focus question: What does all this have to do with distance learning and national parks? Let’s start with my memorable experience of working at Denali National Park and Preserve (DENA) in Alaska as a Geoheritage Education Specialist this past summer. The opportunity to spend the summer at Denali was provided by the Geological Society of America, GeoCorps Program. After a February 2012 phone interview and subsequent invitation to participate, I made the decision to retire from FOSS in order to grab this opportunity. I made the long trip to Denali in June 2012 and became involved with staff at the Murie Science and Learning Center, working on the development of a distance-learning program focused on the geology of Denali, the mountain.

Distance learning via the Internet has become a component of many national park education programs. One of the first of these programs that I became acquainted with was at Grand

References


Don’t Believe Everything You Think

Epistemological bumper sticker sighted in Berkeley, California

Continued on page 22
Creating a Coherent Science Curriculum
By Kathy Long, FOSS Assessment Coordinator, the Lawrence Hall of Science

S
ince FOSS first entered classrooms in the early 1990s, it has always consisted of a collection of related modules, each designed to be taught at a particular grade-band. FOSS has always been designed as a curriculum focused on a limited number of core ideas, so that we are better able to guide students more deeply into those ideas and develop practices that help them understand how science functions. We want students to see that knowledge is created over an extended period of time, requiring argumentation and confirmation. When A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas was published in 2012 (National Research Council), FOSS developers celebrated its content, as it conveyed the same vision we have pursued from the beginning, and it pushed us to extend our vision even further.

The topic of this article will focus on one aspect of that framework: the notion of learning as a coherent progression.

If mastery of a core idea in a science discipline is the ultimate educational destination, then well-designed learning progressions provide a map of the routes that can be taken to reach that destination. —(NRC, 2012, p. 26)

FOSS uses the term learning progression to describe a sequence of concepts and/or skills to be learned that lead logically from simple to complex knowledge of the natural world and its activities. Learning progressions are important in curriculum development. First, they help guide the selection of investigations that will be pursued at various grade levels, ensuring that they build on prior understanding and support increasingly sophisticated learning. In general, FOSS designs its progressions through the grades in a way similar to that described in the framework.

In grades K–2, we choose ideas about phenomena that students can directly experience and investigate. In grades 3–5, we include invisible but chiefly macroscopic entities, such as which is inside the body or the earth, with which children will have had little direct experience. When microscopic entities are introduced, no stress is placed on understanding their size, just that they are too small to see directly. However, pictures, physical models, and simulations can represent the entities and relate them to phenomena that the students can investigate and interpret. In grades 6–8 we move to atomic-level explanations of physical phenomena and cellular-level explanations of life processes and biological structures, but without detail on the inner workings of an atom or a cell. —(NRC, 2012, pp. 33–34)

The second important reason for learning progressions is that they guide assessment development—especially when the assessment is meant to be diagnostic (formative) and intimately connected to the curriculum. By designing the presentation of the curriculum content and practices, as well as assessment around explicit progressions, we can ensure the coherence of the entire learning experience.

This can best be described through example. Let’s take a look at one FOSS-designed progression in the FOSS Third Edition program—matter. The big idea developed through the matter progression is chemistry, the study of the structure of matter and the changes or transformations that take place within those structures. Learning about the properties and behaviors of substances gives us knowledge about how objects and systems go together and how they can be taken apart. Learning about changes in substances can inform the development of new materials and new ways to produce energy.

To develop a thorough understanding of scientific explanations of the world, students need sustained opportunities to work with and develop the underlying ideas and to appreciate those ideas’ interconnections over a period of years rather than weeks or months. —(NRC, 2012, p. 26)

Let’s take a look at how instruction proceeds as we advance through the grades in the matter progression.

In the Materials in Our World Module, kindergarten students focus on several classes of matter—paper, wood, rock, and fabric—all very common materials in every child’s world. But how closely have most children really looked at those materials? Materials in Our World provides experiences that heighten kindergarten students’ awareness of, curiosity about, and understanding of the physical world. Students investigate a wide variety of examples of the materials (e.g., ten different samples of fabric) to see what happens when water is dropped on them, they get dirty, or they are immersed in water. Students spend time exploring how to change the shape of materials, such as sanding wood, folding paper, or unweaving fabric. They engage in activities that help them see how different materials can be transformed into objects that are useful to people. Students continue to explore transformation by freezing water to solid ice and letting it melt again into liquid.

In the Solids and Liquids Module, students (grades 1–2) continue to build a foundational repertoire of materials, and their properties and interactions. More emphasis is placed on what defines something as a solid versus a liquid or a gas. For example, if you have a substance such as cornmeal that pours like a liquid and takes the shape of the container (to a certain extent), why do we call that a solid rather than a liquid? If you have a substance like toothpaste or peanut butter, how do you determine whether it is a solid or a liquid? Students’ conclusions about the materials in this module prepare them to develop claims and defend them with evidence. Students continue to explore change of state between solid and liquid and are introduced to mixtures, some that can be easily separated, and others in which a solid dissolves in a liquid.
In the Measuring Matter Module, students (grade 3) begin to quantify matter, measuring length, mass, volume, and temperature. They think more deeply about what causes material to change state (change of temperature). They also investigate mixtures in more detail. They refine the idea that different things happen when two materials are put together in a mixture: sometimes nothing (they are intermingled, but easily separated), at other times they form a solution (one dissolves in the other), and sometimes, they react creating new materials. In any of these cases, however, matter is never destroyed or created. Introducing the proposition of conservation of matter, helps students reason through changes that appear to refute the rule.

In the Mixtures and Solutions Module, students (grade 4–6) investigate and think more deeply about how mixtures are separated, what happens when something dissolves (how concentration changes as more solute is added to a mixture until it is saturated), and what is going on when there is a chemical reaction and new products are formed. Students are encouraged to begin exploring these ideas at the molecular level. Here is where the concept of conservation of matter that was introduced in earlier grades becomes particularly important.

The Chemical Interactions Course, is the middle school course that builds on everything students have learned in elementary school. Students conduct experiments to observe macroscopic transformations of matter to construct and refine a kinetic particulate model to explain those observations. The course provides students with a diverse mix of empirical experiences with materials and theoretical models that converge to help students construct a basic understanding of the composition of their world and the energy interactions that maintain and transform the world.

To help make these progressions more explicit to educators using FOSS Third Edition, we have created several charts that can be found in the Overview and the Assessment Chapters for each module. In the Overview Chapter of each module, you will find the Module Sequences chart (see previous page). This chart gives you a broad view of the articulation of Third Edition modules that build on one another for grades K–6. The Conceptual Framework (shown at the top of this page) appears in the next section of the Overview and shows the core ideas and concepts for a given strand. The Content Sequence (shown below), a more detailed view of the content to be learned in each module in a strand, appears next in the Overview. This chart provides more detail for the ideas that are developed in the different modules across the years, including middle school. The smaller pieces of each concept we refer to as elements (bulleted sentences in the cells). It is always helpful for a teacher to know what students have learned in past years and where they are going in the future.

Whereas the Conceptual Framework shows which core ideas and concepts are consistent for all modules in a K–8 strand, the Content Sequence, with its module-specific elements, shows what is taught to advance understanding of the core ideas at each level; these elements change as students progress and add complexity and nuance to the ideas.

In the Assessment Chapter, you will find the Benchmark Assessment Summary chart. This chart displays the Conceptual Framework and incorporates the module-specific elements for that module. The items used for embedded and benchmark assessments are designed to be used formatively to help make students’ thinking more explicit. This provides teachers with sufficient information to guide students to the desired understandings of the concepts.

We believe that if school districts follow the progressions we’ve created, their students will leave middle school with a firm foundation in science and engineering that will serve them well throughout their secondary and post-secondary education and into adult life.
Every area on Earth’s surface has a geological history, some more complicated than others. Geologists spend their entire careers trying to decipher the clues they identify in the rocks and landforms to help tell the geological story of local areas, regions and the Earth as a whole. In FOSS, students begin learning about these geological clues, beginning with the tiniest grain of sand up to the mostly unseen forces that shape the Earth, both its surface and interior.

There are a number of books and web resources that can help you guide your students in their exploration of the local geology. Some of the books can be read and interpreted by your students, others will provide insights for you. You may even be inspired to visit some of these locations, on your own or with your students, for a firsthand experience with your local geology. The following are just a few of these resources, many from my own bookshelf.

As always, if you have found a book that you think other FOSS users should know about, please send the reference to foss@berkeley.edu, including author, title, ISBN, and a short annotation.

Roadside Geology/Geology Underfoot Series
Mountain Press Publishing Company
http://mountain-press.com/

One of the first geology books I bought when I moved to California a while back was Roadside Geology of Northern and Central California by David Alt and Donald W. Hyndman (ISBN 0-87842-409-1). This was one of the first in the series of Roadside Geology books and one that I found very valuable as I began to explore the complicated geology of California. Since then Mountain Press has published over 25 more geology guides in two series, Roadside Geology and Geology Underfoot. The Roadside guides include background chapters about the state’s geology, including a geologic time scale, history, and information about the state’s geologic resources and landforms. The road guides follow the major roads and interstates and include maps, photos, and illustrations to help you locate the various geological features. The series is authored by professional geologists and written for anyone interested in learning more about the geology of an area.

Written in Stone: A Geological History of the Northeast United States

The geological history of the northeast United States is part of the story of the landscape from Maine to New Jersey. This book describes the geological events and the landforms that were created and destroyed as tectonic plates collided and moved apart and erosion left its mark. The familiar landforms of the area all have a story that can be read in the clues written in the rocks of the Northeast. Characters in the geological story include dinosaurs, mass extinctions, mountain ranges, earthquakes, and even the tiniest grain of sand.

Stories in Stone: Travels Through Urban Geology
You might say, \textit{Where can my students observe geology when my school is located in a very urban area?} This book may provide the answer, just look in the structures that have been built around you. There’s petrified wood in a gas station in Colorado, fossils and tracks in the brownstone facades of buildings in New York City, cross-bedding in the sandstone of Boston’s St. Paul’s Cathedral, and granite and gneiss in many of the sturdiest structures in the urban environment. This book will likely spur your curiosity about where the building rocks you observe in your urban community originated.

\textbf{Under Michigan: The Story of Michigan’s Rocks and Fossils}

Written for younger readers, \textit{Under Michigan} explores the rocks and landforms of the Upper and Lower Peninsulas of Michigan. With colorful illustrations, readers are introduced to the rocks, topography, and “underworld” of Michigan, beginning with the Pre-Cambrian turmoil that left behind the copper-bearing rocks of the Upper Peninsula to the swamps and shallow seas that left behind fossils and salt deposits of the Lower Peninsula to the glaciation that shaped the entire state during the Ice Ages. (Note: You may want to do a search for “Local Geology” to locate books for students about your region.) Grades 3 and above.

\textbf{FOSS for the Lone Star State}
We are proud to announce the new FOSS K–5 Texas Edition. The state’s new STAAR assessment requires in-depth understanding of the Texas Essential Knowledge and Skills (TEKS) and no program will prepare students for that better than the FOSS Texas Edition. This new program was built to the rigor of the TEKS through research-based approaches. Texas students and teachers will benefit from our decades of experience in designing curricula that combine active investigation, reliable embedded assessment, literacy integration, and technology resources.

With the NSTA National Conference in San Antonio this year, Texas teachers will get a sneak preview of the new FOSS Texas Edition and can attend one of our workshops where they can see it in action. For more information on all things FOSS Texas, go to www.delta-education.com/TexasFOSS.

For information about Summer 2013 workshop opportunities geared for leadership teams to explore the FOSS K–5 Texas Edition, contact Karen Stevens at karen.stevens@schoolspecialty.com.

\textbf{Conversion Kits for FOSS Third Edition}
Revising ideas and processes isn’t just something we tell students to do. It’s at the core of our effort to provide teachers with the best science curriculum possible. By combining current research, best practices, and feedback from teachers, we’ve made FOSS Third Edition more effective, more teacher-friendly, and even more engaging.

And now we’ve even made it easy to convert from FOSS Second Edition to FOSS Third Edition. Whether you want to get new kits or convert some that you already have, we can help you implement a strategy that works for you. Go to www.delta-education.com/FlyWithFOSS3E to request more information about how to get more!

\textbf{Summer 2013 FOSS Third Edition Workshops at the Lawrence Hall of Science}
For opportunities to participate in a FOSS Third Edition workshop for administrators and lead educators, contact Karen Stevens at karen.stevens@schoolspecialty.com.

\textbf{FOSS Chosen as one of DA’s Top 100 Products for 2012}
FOSS is very proud to have FOSS Third Edition chosen by District Administration (DA) readers as one of the “2012 Readers’ Choice Top 100 Products.” This list is comprised of “innovative products have made a positive difference in the operation of [readers’] schools and classrooms.” http://www.districtadministration.com/article/2012-readers-choice-top-100-products

\textbf{Fall 2012 FOSS Newsletter Correction}
Editor’s Note: In our last issue, 40, the article “Kindergarten Science in the United States and Japan” mistakenly omitted the following authors: Takuya Kotani, Noboru Tanaka, Yoshiko Nagase, and Kyoko Mine, Osaka Ohtani University, Osaka, Japan.
A fourth-grade teacher leads a discussion asking students to summarize their findings after an active investigation on how an electromagnet works. Students discuss their ideas in small groups. “You need to wrap an insulated wire around an iron core,” shares one student. “You also have to connect the wire to a source of electricity,” adds another. “Whenever you have an electric current flowing through a wire, you have an electromagnet. If you have more winds around the core, or add more D-cells, the electromagnetism gets stronger,” contributes an astute fourth grader.

“Now take a few minutes and write your ideas about how an electromagnet works in your notebooks,” directs the teacher. After a few minutes, the teacher continues, “We are going to read an article on electromagnetism from our Science Resources book and look for details and examples that support your ideas of how an electromagnet works.”

Some students begin to read independently. The teacher calls a few students to the rug for additional support. Two students put on headphones, open their books, and follow along as they listen to the article being read; four other students begin partner reading. After a few minutes, several hands are raised in the room. They all report finding ideas in the text similar to the ones they wrote in their notebooks. The teacher transitions into a minilesson about the differences between citing what the text says explicitly and drawing inferences.

With the call to implement the Common Core State Standards for English Language Arts (CC ELA) in almost every state, teachers are pressed to learn how to effectively deliver more depth and rigor in reading, writing, speaking and listening, and language instruction. The goal of these standards is “to help ensure that all students are college and career ready in literacy no later than the end of high school” and that students build strong content knowledge across a wide range of subject matter topics. This is a worthy endeavor that calls for an alignment of literacy and content area instruction; however, some educators view this as an opportunity to build science content knowledge through literacy by providing students with books,
### Linguistic accommodations table for English learners, grades 2–5

**Science-Centered Language Development**

<table>
<thead>
<tr>
<th>Level</th>
<th>Accommodations</th>
</tr>
</thead>
</table>
| **Beginning** | - Use beginning-level supports when introducing new concepts.  
- Allow for thinking time, simple sentence responses, and use of present tense.  
- Provide sentence frames and word walls.  
- Model and have students practice pronunciation of vocabulary words and sentence structures.  
- Point out high-frequency English words and phrases.  
- Provide oral language practice.  
- Provide opportunities for notebook entries that require simple, high-frequency English mostly in present tense.  
- Use the beginning-level scaffolds.  
- Provide opportunities for notebook entries that relate directly to the active investigation, and require simple, high-frequency English mostly in present tense. |
| **Intermediate** | - Allow for processing time and supports from lower levels when needed.  
- Encourage students to request clarification, repetition, and rephrasing.  
- Allow for processing time, simple sentence responses, and use of present tense.  
- Provide sentence frames and word walls.  
- Model and have students practice pronunciation of vocabulary words and sentence structures.  
- Provide support with less common and new science words.  
- Define multiple-meaning words.  
- Provide support for developing meaning-making skills and applying basic and higher-order comprehension skills.  
- Provide visuals, and teacher/peer assistance to determine or clarify meaning with unfamiliar topics.  
- Provide support for notebook writing when concepts are abstract and challenging.  
- Encourage use of complex verbs, tenses, grammar features, and sentence patterns.  
- Support use of cohesive devices.  
- Encourage detailed and clear notebook entries with narrations, explanations, and descriptions.  
- Provide supports with new science vocabulary.  
- Provide opportunities for entries using clarity and precision with regard to vocabulary and language structures.  
- Provide minimal or no scaffolds for writing about complex, abstract ideas using science vocabulary. |
| **Advanced** | - Provide processing time and supports from lower levels when needed.  
- Encourage students to request clarification, repetition, and rephrasing.  
- Allow for pauses to restate, repeat, or search for words and phrases to clarify meaning.  
- Provide opportunities for oral discourse.  
- Give support with low-frequency or academically demanding vocabulary when necessary.  
- Introduce higher-level language functions.  
- Provide opportunities for developing meaning-making skills and applying basic and higher-order comprehension skills.  
- Provide visuals, and teacher/peer assistance to determine or clarify meaning with unfamiliar topics.  
- Provide support for notebook writing when concepts are abstract and challenging.  
- Encourage use of complex verbs, tenses, grammar features, and sentence patterns.  
- Support use of cohesive devices.  
- Encourage detailed and clear notebook entries with narrations, explanations, and descriptions.  
- Provide supports with new science vocabulary.  
- Provide opportunities for entries using clarity and precision with regard to vocabulary and language structures.  
- Provide minimal or no scaffolds for writing about complex, abstract ideas using science vocabulary. |
| **High Advanced** | - Provide processing time when necessary.  
- Use supports from lower levels for complex ideas and new science vocabulary and language structures.  
- Provide opportunities for oral discourse.  
- Give support with low-frequency or academically demanding vocabulary when necessary.  
- Introduce higher-level language functions.  
- Provide opportunities for developing meaning-making skills and applying basic and higher-order comprehension skills.  
- Provide visuals, and teacher/peer assistance to determine or clarify meaning with unfamiliar topics.  
- Provide support for notebook writing when concepts are abstract and challenging.  
- Encourage use of complex verbs, tenses, grammar features, and sentence patterns.  
- Support use of cohesive devices.  
- Encourage detailed and clear notebook entries with narrations, explanations, and descriptions.  
- Provide supports with new science vocabulary.  
- Provide opportunities for entries using clarity and precision with regard to vocabulary and language structures.  
- Provide minimal or no scaffolds for writing about complex, abstract ideas using science vocabulary. |

writing prompts, and topics for presentations about sharks, dinosaurs, or volcanoes. While these topics might be engaging, rarely are they a fundamental part of state science content standards. If the goal is for students to build strong content knowledge and develop the high level of literacy skills associated with CC ELA, then teachers need to integrate CC ELA standards into robust articulated science experiences.

So how do you strategically integrate the CC ELA standards with subject area instruction, such as science? Start with FOSS. All the FOSS investigation parts follow a similar flow that allows students to develop science content knowledge while they hone their abilities to read, write, speak, listen, and acquire and use vocabulary. The general flow of most investigations begins with activating prior knowledge, followed by a question or challenge designed to be resolved with a hands-on activity, followed up with discussion and vocabulary review, that concludes with students demonstrating their knowledge of the science content by writing an answer to the focus question. Reading extends the content learning, and response sheets give students opportunities to apply the content they’ve learned to new situations. These steps are repeated in each investigation, requiring varying degrees of language demands. FOSS takes care of the science content, and by planning ways to integrate, teachers can help students develop and apply CC ELA standards during each part. Let’s take a closer look at how the

*Continued on page 20*
Planning for FOSS continued

CC ELA standards can be addressed by following three steps: identifying CC ELA standards already developed during the active investigation, identifying CC ELA standards to support the science content, and considering how to differentiate instruction.

**Step 1.** Identify which standards can be developed naturally and/or applied during the active investigation. Every lesson starts with context, where a concept is introduced or reviewed. This is intended to activate prior knowledge through class or small group discussions where students present information, findings, and supporting evidence (Anchor Standard 4 for Speaking and Listening) based on prior experiences. Students are then given a focus question or challenge that sets the objective for the science content learning.

During the **active investigation**, students work in heterogeneous collaborative groups. This provides a safe environment for all students to prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others’ ideas and expressing their own clearly and persuasively (Anchor Standard 1 for Speaking and Listening).

Next comes **data management**, where students make observations, record, and organize data in their notebooks. A notebook provides a space for students to recall information from experiences (Standard 8 for Writing); and to use accurately a range of general academic and domain-specific words and phrases (Anchor Standard 6 for Language).

The **analysis** phase involves discussing data and constructing and writing explanations. At this critical juncture in the lesson, students are making sense of the hands-on experience. The focus question provides an authentic and engaging context for students to develop and apply writing skills necessary for higher level tasks such as writing arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence (Anchor Standard 1 for Writing) and conducting short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation (Anchor Standard 7 for Writing).

Students **read** articles in Science Resources after the active investigation to reinforce and enrich conceptual understanding. These readings provide an opportunity for students to read and comprehend informational text independently and proficiently (Anchor Standard 10 for Reading) and to meet other reading standards described below.

**Step 2.** Determine a CC ELA standard that supports the science content learning through reading, writing, speaking, listening, or the acquisition and use of language. To help identify which standards to integrate, review the investigation part you will be teaching with these questions in mind:

- What will students be learning? For the science content objectives, see the first page each of investigation in Investigations Guide.
- How will they learn it? Refer to the scientific and engineering practices (pedagogies), listed on the first page of each investigation in Investigations Guide.
- Which language arts skills can be introduced and/or exercised to support science concept development? Review the Guiding sections, paying particular attention to the language development opportunities in each step. How will students describe or communicate what they have learned? How will they engage in oral discourse? What speaking and listening skills do students need to build? What types of notebook entries will support the science learning? What types of formal writing can students do after the investigation to communicate their understanding? How can that writing be further developed through a formal writing process during language arts time? How can students engage with the text to extend key ideas or determine craft and structural elements?

Strategies for addressing CC ELA standards will vary from lesson to lesson. Some will be developed during the lesson, such as speaking and listening standards, and some will be developed after the lesson, such as cite specific textual evidence when writing to support conclusions drawn from the text (Anchor Standard 1 for Reading). Planning to integrate the standards of the CC ELA with the standards of science means the time devoted to each will be integrated, making more efficient use of instructional time.

**Step 3.** As with any teaching, you need to consider differentiation, especially if you have students who are learning English. To plan an integrated science lesson that addresses the language acquisition needs of your English learners (ELs), first identify their level of language proficiency (e.g., beginning, intermediate, advanced), then determine the types of accommodations they will need for the science content and Common Core Standard. The FOSS Linguistic accommodations table for English learners (see pages 18-19) offers suggestions for scaffolding the language objectives in each domain—listening, speaking, reading, and writing in a FOSS lesson. You can also refer to the Science-Centered Language Development chapter in Teacher Resources (Third Edition) or on FOSSweb (www.fossweb.com) for more ways to integrate language development strategies into FOSS activities.

Integrating takes time and effort, but the payoff is more authentic learning experiences that address the depth and rigor of the CC ELA. Science content is an engaging and motivating context for processing and communicating oral and written language in ways that are accessible and relevant to students.
FOSSweb Tips and Tricks
As you’ve no doubt read here before, FOSSweb.com has undergone a major revision. If you haven’t checked out the new FOSSweb, read on for some practical information on getting set up and some great reasons why to switch!

How do I get to the new FOSSweb?
If you go to FOSSweb.com, you should see a big banner at the top of the page titled “The New FOSSweb Has Arrived!” If you don’t see an image of the new homepage, click on the arrow at the right to open this banner. Click on the image of the new homepage.

How do I register for a new FOSSweb account?
In order to gain access to the full suite of module resources, we recommend registering for an account on the new site. Click on the “Register” button on the bottom of the new home page. Follow the steps to complete your registration using your school e-mail address. We encourage our users to register as a part of an organization (your school or district), if applicable. Registration requires your school e-mail address, district or school address information, and a password that is at least eight characters in length. A confirmation e-mail will be sent to your e-mail address, and you must click on the link to complete your registration.

How do I activate access to my purchased modules?
Once you log in to FOSSweb, you will be brought to your Teacher Page. Select the “Add to My FOSS Modules” button in the My FOSS Modules header. If you have purchased a FOSS Third Edition module, you will find a FOSSweb access code inside the cover of your Investigations Guide. For the FOSS Third Edition, each code is module specific and will provide you with full access to FOSSweb teacher resources for that module after online activation.

If you use editions published before Third Edition, such as, Second Edition, Middle School First Edition, or California Edition, you will need to request an access code. You can do so from the homepage of the new FOSSweb by clicking on the link titled “Previous Users, Click Here,” or by going to FOSSweb.com and clicking on the “Request More Information” button. You will fill out a short form (found at http://fossweb.com/news/fossweb_signup.html), and should receive your access code within an hour of signing up.

Once you have your code, enter it into the first page of the Add a New Module dialog box. On the second page, select which module(s) you want to appear in My FOSS Modules. We suggest you select only the modules you use most. You can always add or remove modules from this area later. Note that a module must be in My FOSS Modules in order to assign it to a class. If you have a premium code, you can enter it on this page. Click Submit and wait for your Teacher Page to reload.

How do students and families access FOSSweb?
Students and their family members can access FOSSweb by visiting as a “guest” without logging in with a username and password. As a guest, students use the pull-down menu to answer the questions: Who are you? [student], Where are you? [pull down state], and What grade are you in? [pull down grade]. By answering these questions appropriately, FOSS modules for their state and grade level will be accessible to students. Students can click on a module, represented by the cover of the FOSS Science Resources book, to gain access to the module resources. Guest users have access to online activities, media library, and documents for families.

The only time students need a student login is to access premium content, such as the eBooks. Teachers who have access to premium content should use the FOSSweb teacher management tools to create a class username and password. The class username and password should be shared by all the students in a class, as well as any family members who wish to view FOSSweb resources. Students can log into FOSSweb and access module-specific resources, notes from teachers, and purchased eBooks.

Why should I start using the new FOSSweb?
The new site was redesigned to include many new features with educators in mind. These include:
- iPad-friendly content such as new multimedia, eBooks, and videos
- Easy access eBooks and Guides and Interactive Whiteboard content
- Resources for a module available on a single page, and resources for each investigation part available through Resources by Investigation
- Class pages that allow teachers to post notes and assignments to each class

How long can I keep using the old FOSSweb?
We know that many of our users are used to using the old FOSSweb and know exactly where to go to find the module resources they use everyday. Therefore, we plan to keep the old FOSSweb up until January 2014. Here are a few important dates:
- In June 2013, the FOSSweb.com URL will go to the new FOSSweb, but you will have the option of using the old FOSSweb.
- In January 2014, the old FOSSweb will be retired, and all users must be registered on the new FOSSweb.

Introducing... FOSSmap!
We are pleased to announce the launch of FOSSmap! Formative assessment made easy and efficient! The new FOSSmap program will make it easy and efficient for you to use the FOSS assessment system. FOSSmap is now available for FOSS Second and Third editions!

Some features include:
- Online assessments for students using FOSS Third Edition (coming Spring 2013)
- Automatic coding of many items, or easy review for others
- Printable reports for both embedded and benchmark assessments
- Online next step strategies identified

Use your FOSSweb username and password to get started with FOSSmap. You will need to have activated a module in FOSSweb in order to use FOSSmap. To get to FOSSmap, log into the new FOSSweb and click on FOSSmap in the right-hand navigation menu.

We want to hear from you!
Please send us your feedback! We want to hear any of your concerns, questions, or accolades about FOSSweb! Send an e-mail to support@fossweb.com or call our support line at 510-643-6997.
Denali Rocks curriculum as a resource.

Firsthand Experiences continued

Canyon. It was the Grand Canyon program that became a model for what we developed at Denali. Since funding for field trips is often not available, and many students don’t have opportunities to visit national parks, distance learning provides a chance to have the next best thing to a firsthand experience, a nearly close encounter with an educator who lives and works in a national park.

The Denali education program for teachers includes three components: the park as a classroom, which includes curriculum materials, field trips, institutes, field schools, camps, materials to loan, and guest speakers; professional development, including teacher workshops and opportunities to work at Denali as a Teacher-Ranger; and distance learning. The development and implementation of distance learning at Denali was the big goal for our summer’s effort.

Skype® is used as the delivery method to bring the program to the classroom; a Microsoft® PowerPoint® presentation and an accompanying script that would later be used by Denali education staff also had to be developed. I used the existing Denali Rocks curriculum as a resource. This curriculum included enough material to last one to two weeks in a classroom. My challenge was to come up with a distance learning presentation for fifth- and sixth-graders.

With Sierra McLane and Rachel Jencks, other members of the Denali education team, we narrowed the topics down to:

- What makes the mountain called Denali (Mt. McKinley) so special, i.e., elevation, formation, location?
- What kind of rock is Denali made of?
- What forces have shaped Denali, e.g., glaciers, water?
- What does plate tectonics have to do with Denali?

We knew what we wanted to include in the program but were having a tough time coming up with a way to make it exciting. I had just had the opportunity to take a “flightseeing” tour that landed on the Ruth Glacier on the flanks of Denali. From our conversations about mutual experiences at Denali, we decided we needed to create a character that would experience Denali with the eyes of a new visitor. The inspiration gave birth to Sue the Geologist. Sue eventually became sort of a “Where’s Waldo?” character in the presentation, flying into Denali, exploring the glaciers, and climbing Denali, experiencing the shaking brought on by an earthquake along the way.

We tried out several versions of the program, enlisting staff at the Murie Science and Learning Center, park interpreters and tour bus drivers, staff from Aramark (the park concessionaire), and local students as guinea pigs. We set up the computers, backlit screen, and projector in a Murie classroom and communicated with the “students” sitting in a conference room on the other side of the science center.

A big goal was to have students in the distant classroom be actively involved with the presenter at Denali. Teachers are provided with classroom materials and online videos to share with students before the encounter with the Denali educator. In the Denali Geology program, students watch a four-minute segment of Climbing Mt. McKinley and complete a short reading that provides them with background information about the mountain, including its elevation and climate. They are presented with a focus question, Why is Denali so high? During the distance-learning portion, the educator involves students in brief activities that demonstrate the difference between elevation and relief, oolitic glaciers, and plate motions. To help bring all of the ideas together at the end of the presentation, students learn a hula that incorporates movements to illustrate subduction, uplift, and erosion.

When I left Denali in August 2012, we had yet to try the geology program out with an actual classroom of students. The team at Denali hopes to recruit classrooms for the presentation and to provide feedback as they make improvements on the experience. One of the minor difficulties staff at Denali face in communicating with the lower 48 is the time difference. Denali is in the Alaska Time Zone, which is four hours behind eastern time. So presentations for classrooms in New York can’t begin until early afternoon. The seasons also play a role in scheduling presentations. Denali National Park and Preserve basically shuts down during the winter, with a smaller staff maintaining the park and providing a much smaller schedule of programs. Having access to the technology needed to connect is also a problem for some schools. None of these obstacles are insurmountable but do need to be considered.

So, back to the focus question: What does all this have to do with distance learning and national parks? Firsthand experiences for students are an important part of their education in the sciences. Making connections with the real world can enhance student interest in the sciences and provide memories on which they will build their future ideas. The national parks provide abundant resources to help provide those experiences, whether through park visits or other curriculum materials. Check out some of the web resources listed here as you teach FOSS modules and courses. You will likely find a connection to a topic you are teaching and can help your students make personal connections with National Park Service educators and rangers. Distance-learning experiences connect students with the folks who spend their life caring for and promoting the parks. These personal connections might even inspire students to think of careers involving science.

Thanks to the National Park Service (National Park Service, Geoscientists-In-The-Parks (GIP) Program) and staff at Denali National Park and Preserve, especially Sierra McLane and Denny Capps, in making and supporting the Geoheritage program and to the Geological Society of America, GeoCorps Program for their support.

Resources

National Park Service Interpretation and Education
http://www.nps.gov/learn/

Parks with Distance Learning Opportunities: Bringing the Parks into Your Classroom
http://www.nps.gov/learn/distance.cfm

Denali Distance-Learning Opportunities
http://www.nps.gov/dena/forteachers/learning/index.htm

Denali: The High One (Geology of the Mountain)
http://www.nps.gov/dena/forteachers/learning/geology.htm
FOSS Institutes

Delta Education will host two one-day FOSS Institutes before each of the three NSTA Area Conferences in Portland, Oregon (10/23); Charlotte, North Carolina (11/6); and Denver, Colorado (12/11).

These Institutes, one for K–5 and one for middle school, will be for educators from districts that have implemented FOSS or are planning to implement FOSS. The Institutes will focus on newly developed FOSS materials—new FOSS Third Edition for K–6 and the newly revised Second Edition Middle School courses.

These Institutes are designed for experienced FOSS educators—lead teachers, administrators, curriculum coordinators, professional developers, and university methods instructors. These Institutes are free, but you must register in advance to attend.

To secure your spot at an Institute, please write, fax, or e-mail:

Pam Frisoni
Delta Education
80 Northwest Boulevard
Nashua, NH 03063
pam.frisoni@schoolspecialty.com
Fax: 920.882.4598

NSTA 2013 NATIONAL CONFERENCE
San Antonio, TX April 11–14, 2013

FOSS K–8 Workshop Schedule
Thursday, April 11, 2013
8:00–10:00 Science-Centered Language Development
Using FOSS
10:30–11:30 Asteroid! Will Earth Be Hit Again?
Planetary Science for Middle School
12:00–1:00 NASA’s Kepler Mission and the Hunt for
Exoplanets—Planetary Science for Middle School
1:30–3:00 Engage Students with Active Learning through
FOSS Third Edition
3:30–5:00 If You Want the TEKS in their Minds,
Put FOSS in Their Hands (Texas Edition)

Friday April 12, 2013
8:00–10:00 Using Science Notebooks to Impact
Student Learning with FOSS
10:30–12:30 FOSS Formative Assessment:
Making Student Thinking Visible
1:00–2:30 Taking Science Outdoors with FOSS K–6
3:00–4:30 A Sneak Preview of FOSS Earth History,
Second Edition for Middle School

STEM FORUM & EXPO 2013
St. Louis, MO May 15-18, 2013
Materials in Our World (Early Childhood)
Designing with Electrons (Grades 4–6)
Electronics for Middle School

SUMMER 2013 CALENDAR

FOSS Third Edition Workshops
For opportunities to participate in a FOSS Third Edition workshop for administrators and lead educators, contact Karen Stevens at karen.stevens@schoolspecialty.com.

Middle School Institutes
The Lawrence Hall of Science, Berkeley, California

July 16–19 (Tuesday–Friday)

July 22–24 (Monday–Wednesday)
Implementing Scientific and Engineering Practices:
Force and Motion Course

July 25–26 (Thursday–Friday)
Implementing Scientific and Engineering Practices:
Electronics Course

Follow us on Facebook and Twitter!

http://www.facebook.com/FOSSscience
http://twitter.com/FOSSscience

For more information about the workshops on this page and other professional development opportunities, visit the FOSS Professional Development calendar at http://www.fossweb.com/news/calendar.php.
You’re already running with FOSS. Now, with FOSS Third Edition, you can fly.

Sprout wings with these features in FOSS Third Edition:

- Embedded and benchmark assessments provide ways to continually monitor learning.
- Enhanced technology engages students and provides management tools for teachers.
- Embedded science notebook strategies solidify students’ understanding.
- Content area readings provide students with regular encounters with informational text.

Contact us to discuss conversion kits and other transition pathways to help you move to FOSS Third Edition.