The Bayview Zone of San Francisco Unified School District (SFUSD) consists of seven schools that include approximately 1,800 pre-K–12 students—schools that serve the highest concentrations of African-American students in the district. Emmanuel Stewart was a former teacher in one of those schools; he presently works as the Science Literacy Instructional Program Administrator in the Bayview Zone.

As a fifth-grade elementary school teacher, he worked hard to find avenues to teach science, as teaching science was not necessarily a given at all schools. One unintended consequence of the No Child Left Behind era was an overemphasis on the subject areas of language arts and math, sometimes to the exclusion of other critical areas. Among these “other areas” was science.

As a teacher, Emmanuel participated in a district sponsored science program called WISE, Working to Improve Science Education, funded by a Math Science Partnership Grant. Through WISE, SFUSD teachers benefitted from lesson planning support and in-class coaching. Emmanuel credits his participation in this program, specifically the support he received from his WISE coach, for enhancing his science content knowledge and quality of instruction. Participating in the program helped him create engaging, inquiry-based learning experiences for his students. However, it wasn’t until he stepped out of the classroom and into multiple other schools as a science coach, assessing the state of science teaching and learning in the Bayview schools, that Emmanuel realized that not all teachers benefitted from the same access to ongoing professional development and support for science instruction that he had experienced.

Bayview schools have been subject to multiple reform efforts over the years, all of them with the goal of improving student learning outcomes as measured by high stakes tests in language arts and math. This pressure, coupled with relatively high rates of staff turnover year after year and diminishing resources for schools, helps explain why science
Opening the Gateway continued

dropped off the radar. Dropping off the radar meant that implementation of the district’s adopted science program, FOSS, was disorganized and incomplete. There was no system for refurbishing kits to ensure teachers had access to the necessary materials to run investigations in their classrooms. In some cases, FOSS kits were completely missing. New teachers didn’t have opportunities to learn about FOSS. And there wasn’t dedicated time—in the instructional day or in teacher planning time—for science.

Emmanuel knew all of these barriers had to be addressed if Bayview students were to have regular opportunities for rich science learning. He asserts, “After all, science is one of the subjects that is a gatekeeper to more advanced learning, and we all—regardless of culture, race, social class, gender, religious belief or any other difference—have a natural affinity and ability for science learning.”

Emmanuel’s early visits to schools and classrooms informed his plan for increasing science-learning opportunities for all students in the Bayview. Emmanuel worked the first few years at building partnerships and relationships with teachers, students, principals, and science partners within the district and city. He worked to provide leadership and direction for serving the Bayview community in the development of science. He has strengthened relationships with district and city science partners and supported teachers and principals with their development of science through using FOSS.

Emmanuel claims that what teachers mostly needed were the materials and resources to teach science. So, he worked with schools to refurbish their FOSS kits and supplied teachers with science notebooks. Emmanuel was also able to facilitate and connect teachers in Bayview to science partners and organizations in other parts of the city. For example, some Bayview teachers are now partnered with a local science museum, California Academy of Sciences, and are participating in the Academy’s Teacher Institute on Science Sustainability (TlSS). This partnership offers additional professional development, coaching, and materials for science instruction for teachers over two years. Other Bayview teachers are connected with UCSF’s (University of California, San Francisco) City Science program that provides professional development around the FOSS science program. Bayview has also begun to develop partnerships with the Mission Science Workshop in San Francisco. The Workshop helps teachers understand science standards and provides specific support for the exploration portion of science instruction. All of these types of partnerships with local science organizations provide additional professional development, coaching, and materials for science instruction.

Additionally, some Bayview teachers needed a model of what teaching FOSS “looks like.” They had never seen, let alone used, FOSS materials. For these teachers, Emmanuel’s strategy as a coach was to co-plan, then model and co-teach lessons. In this way, teachers would become familiar with the learning goals and instructional materials and have a partner to try things out with. It was through these co-teaching experiences that his rise to science celebrity among the 5–11 year-old set in the Bayview began.

In our conversation, Emmanuel quickly moves the focus from his “celebrity status” to the sincere and spontaneous expressions of excitement and gratitude that come from students simply for being engaged in science inquiry and learning. He emphasizes, “To have these students, the very ones who are overrepresented for special education and discipline, and underrepresented for AP [Advanced Placement] and UC [University of California] admission—yes, I am talking specifically about African-American boys—to have them be this excited about school and about learning, this is what I want to replicate across the Bayview. And science is the natural vehicle.”

Recently, with the support of SFUSD’s Curriculum and Instruction Department, the Bayview leadership team conducted a listening campaign of Bayview teachers and leaders to help better understand their experiences, perceptions, and goals around science teaching and learning. The teachers’ voices consistently
expressed the desire to have more science happening in schools but of being stymied by various barriers. These voices provided direction for the Bayview Zone to remove the barriers and offer the support to allow more exciting science learning to take place in their schools. The first step the Bayview leadership team took was to clearly establish the expectation that all students would receive their full grade level curriculum in science. Guidelines for science instructional minutes have been shared with sites to assist them in creating schedules that include science. Next, Emmanuel worked to ensure that teachers had all necessary materials to use for their adopted FOSS science program. This meant helping sites inventory what they had on-site and identify what was missing. It also meant purchasing science notebooks for every student.

In considering professional development, the Bayview leadership team considered three audiences: teachers, school and district leaders, and families. The team focused on increasing enthusiasm for science by engaging in the practices of science, deepening science content knowledge, and connecting people to science resources and partners. The Bayview leadership team conducted a professional development meeting where district leaders were given a guided tour through the FOSS Teacher Guides and other science support materials. Emmanuel shares, “The site administrators worked in pairs, poring through the science materials, excitedly mapping out units, making connections to literacy and math units currently being planned and taught by their teachers, and begging for two more minutes to just finish this one part. Leaders left this meeting committed to allocating the necessary time and support to teachers for science instruction at their sites.”

For Emmanuel Stewart, being a science leader and coach in San Francisco is very personal. He shares that his philosophy in teaching was implanted in his soul by his grandmother many years ago, as a small child. Emmanuel recounts, “In my earliest years, it was my grandmother who took my brother, sister, and me to Golden Gate Park and to the science academy during the summer months. She would walk us through the park and teach us life lessons from our questions. We would ask our grandmother, “Why are the trees so tall? Who planted those trees? Is the Sun close? Where does the Moon go during the day?” My grandmother didn’t always provide an answer to our questions, but she always responded. She responded through her relationship with us and her hands-on approach. She would tell us to respect God’s earth and don’t pick the leaves from the trees. She would also say, “Only pick up leaves from the ground that fall from the trees. These trees provide clean air for all of us!”

It is Emmanuel’s grandmother’s values and beliefs that he takes with him into every science class and every science lesson. He challenges students to do their best and be confident, stand tall and strong, and question the world around them, just as he did as a small child. He passionately states, "Science learning captures the imagination and curiosity for students and develops a number of transferable skills including literacy, communication, teamwork, problem solving, and analytical thinking. [For these reasons,] I continue to remove the barriers and provide the supports for more science teaching and learning in our schools. And while students don’t need a science rap to know that learning about science is fun, and I don’t need to be treated like a celebrity after teaching a science lesson to know that students love science, all of this access and support is about spreading the love and joy of science in the Bayview. 

Emmanuel reaffirms students’ learning by validating their thinking.
If you haven't moved to FOSSweb 2.0 yet, now is the time!

FOSSweb.com will always be your online resource for the FOSS program. However, in the summer of 2014, the legacy version of the site on http://archive.FOSSweb.com will be retired. At that time, all teachers will need to have accounts and be using content on http://FOSSweb.com, the newest version of the site.

The newest version of FOSSweb.com (“FOSSweb 2.0”) has been available for teachers to use since August 2011 and became the default website in summer 2013. FOSSweb 2.0 can be easily identified as the “blue site” you see when you type in http://FOSSweb.com. Teachers who need access to protected teacher materials should create a teacher account on FOSSweb.com and use an access code to unlock module resources (see “FOSS Tech Corner” in FOSS Newsletter no. 42, Fall 2013).

For the past year, http://archive.FOSSweb.com has housed the legacy version of the site. This site is familiar to many users; module pages have a white background with colorful cartoon characters. The homepage has a yellow background where you can also see some of the cartoon characters. If you are still using content on the old FOSSweb, you will need to create a new account on the new, blue version of FOSSweb.com before the archive site retirement in the summer of 2014. While we know that many teachers are fond of the old FOSSweb, we hope that you will come to appreciate the new features and media items available in the new FOSSweb.

To get started with FOSSweb 2.0, all FOSS teachers who have not already done so should create an account on the new site. If you had an account on the old FOSSweb.com, your account will not carry over. Register for the FOSSweb 2.0 at the URL below.

http://www.FOSSweb.com/getting-started

Once you create your account on FOSSweb 2.0, you’ll need an access code to unlock teacher resources for your specific module. For the FOSS Third Edition, you will find the access code pasted on the inside cover of your Investigations Guide.

For the FOSS Second Edition, you can sign up for the access codes online at http://www.FOSSweb.com/access-codes or use the access codes on this page.

- FOSS 2nd Edition Access Code
  - AME2EL3656

- FOSS Middle School Access Code
  - AMEIMS6950

- FOSS CA Access Code
  - AMEICAI1284

- NYC Access code
  - NYCBEI9833

Have Questions? We are here to help!

For further questions on FOSSweb, please don’t hesitate to contact our technical support team.

- Account Questions/Help Logging In
  - School Specialty Online Support
  - loginhelp@schoolspecialty.com
  - Phone: 800.513.2465, 7:30 am–5:00 pm CT

- General FOSSweb Technical Questions
  - FOSSweb Tech Support
  - support@fossweb.com
  - Phone: 510.643.6997, 9:30 am–5:30 pm PT

Old FOSSweb

Archive.FOSSweb.com will be retired in the summer of 2014.

New FOSSweb

If you have already created an account on the new FOSSweb, you are good to go!
It used to be fairly rare to have students with food allergies, but now it is not uncommon to have multiple students with food allergies in a single class and for those allergies to possibly be severe. While almost any food is capable of causing an allergic reaction, eight foods account for 90% of all food-allergic reactions in the United States: peanuts, tree nuts, milk, eggs, wheat, soy, fish, and shellfish. Allergic reactions range from mild (hives, sneezing, coughing, or gastrointestinal distress) to severe (respiratory distress, tissue swelling, and anaphylaxis). Any contact with the offending food could trigger a reaction whether it is ingested, touched, or contracted through cross contact.

So what do you do if one or more of your students have food allergies, and how do you modify your lessons if those allergies impact instruction? First, be informed. Find out which of your students suffer from food allergies, the severity of their conditions, and the treatment plans the families have in place. Second, bone up on your “Food Allergy 101 facts.” A good place to start is the FARE (Food Allergy Research & Education) website: www.foodallergy.org. This site not only provides good basic information on food allergies, but there are also resources directed specifically to dealing with food allergies in a school setting.

For most allergies, physical avoidance solves the problem. As long as the student doesn’t touch the culprit food, item he or she will not exhibit any reaction. However, this is easier said than done. For those children with severe allergies, even minute contact, such as one child touching it and then touching another object that is then picked up by the allergic child, could trigger a severe reaction. In these situations, it is best to not have that food item in the class at all.

FOSS is very concerned with the health and safety aspects of all students using our curriculum, as well as their scientific intellectual growth. We carefully choose materials that statistically have a low hazardous risk for students and include safety warnings where appropriate (e.g., latex allergy warnings for rubber bands, rubber stoppers, and balloons). However, low risk does not equate to zero risk. We recently heard from a teacher who had concerns with teaching the Structures of Life Module to her third-grade class because she has a student with extreme sensitivities to legumes (such as, beans and peas; note that peanuts are also legumes).

In response to her concerns, we worked with her to identify some alternatives to the beans and peas used throughout Investigations 1 and 2. And of course, in true FOSS fashion, we tested out the substitutions ourselves and found the ensuing experience equally as rewarding as the original. Following are some alternatives that we recommend.

- **Investigation 1, Part 3: Seed Soak**—Students open up lima bean seeds that were soaked overnight to locate and identify the parts of a seed. **Legume alternatives**: corn seeds (the seed coat is a little harder to remove) or pumpkin seeds.
- **Investigation 2, Parts 1: Germination**—Students compare the four types of seedlings they germinated in the minisprouters. **Legume alternatives**: radish or cucumber seeds.
- **Investigation 2, Part 2: Life Cycle of the Bean**—Students take some of the bean seedlings from their minisprouters (or from the class sprouter if necessary) and grow them hydroponically to follow the seedling through its life cycle. **Legume alternative**: cucumber seeds. The cucumbers grew rapidly and vigorously. The fruit, although smaller than if growing in soil, was healthy and sweet.

We understand the seriousness of food allergies in the classroom (visit FOSSweb for a wheat-free alternative to mock rocks). Should you have concerns with your own classroom situation, please contact us at foss@berkeley.edu. We will be happy to work with you to explore possible alternatives for your class.

**Captions (Counter Clockwise from Top Right):**
1. **Cucumber seeds**
2. **Cucumber Plants in hydroponic tank, 7 weeks old**
3. **Marketmore 76 Cucumber, 7 weeks old**
4. **Poona Kheera Cucumber, 7 weeks old**

By Natalie Yakushiji
Over the lifespan of GEMS-Net, the program has coordinated opportunities for more than 70 University of Rhode Island and community scientists and engineers to collaborate with teachers and schools.

GEMS-Net: A STEM Pipeline from Kindergarten to the University
By Erica Beck Spencer, FOSS Project Curriculum Specialist, The Lawrence Hall of Science, and Sara Sweetman, Director of GEMS-Net, Rhode Island

The Guiding Education in Math and Science Network (GEMS-Net) is an outreach project that develops partnerships with K–8 teachers and administrators from nine school districts throughout the state of Rhode Island. Working together with scientists and educators from the University of Rhode Island (URI), GEMS-Net engages with every K–8 teacher of science, advises districts on curriculum, monitors effectiveness, stays current on effective practices, and works to build teacher leadership. The nine GEMS-Net districts are currently using FOSS and other hands-on science programs. Recently, GEMS-Net districts have made plans to move in the direction of FOSS Third Edition adoption.

The purpose of this article is to share more about this partnership program as an example of a large-scale FOSS implementation with quantifiable evidence of improving student understanding and higher test scores. We also hope to share details of this implementation that all teachers can learn from and can implement on a teacher to student level or on a larger scale. We hope all can benefit from the monumental work being done in our smallest state.

The overarching goal for GEMS-Net is to marshal the resources of the local districts and the University to create an effective STEM pipeline encouraging all citizens to become critical consumers of scientific information, to engage in public discourse on science related issues, and to become lifelong learners. The organization has been in existence for over 15 years starting with a National Science Foundation systemic reform grant awarded in 1996 and is one of the longest sustained science education projects in the country.

Professional Development Plan
Over the past 15 years, GEMS-Net has provided professional development for 2,251 teachers, principals, and administrators. Superintendents agree to send their teachers for a set number of PD days annually. New teachers, or teachers who switch grade levels, must attend three full days of PD, one day per module. Substitute coverage is an expense supported by districts. Most other teachers attend one PD day per year. Superintendents and principals are also offered two days of professional development annually. These trainings are not mandatory but are well attended. In addition to providing daylong PD sessions to hundreds of educators, they conduct coaching sessions in classrooms of nearly all of their 53 schools yearly.
Caroline Stabile, a science education specialist for GEMS-Net describes the unique features of their professional development model:

Our professional development is grounded in the context of the classroom. Our teachers really value this aspect of our program. We know from experience and research that the most effective professional development is professional development that is specifically relevant to the curriculum that teachers will teach. In all of our sessions we engage teachers with the instructional materials that they will be using. This affords them the opportunity to become familiar and confident with the physical components of the curriculum. We also provide teachers time to develop their content knowledge in conjunction with the instructional strategies they’ll be using in the classroom. One of the ways that we ensure the quality of our professional development is by involving scientists and engineers in the sessions. This helps us show the accuracy of the curriculum’s conceptual development and also gives teachers a glimpse into the practices of scientists and engineers. Part of our leadership team for every session is a practicing teacher leader who is very familiar with the curriculum. This brings credibility and practicality that our teachers really appreciate.

University professors help the program in numerous ways. They join the curriculum trainings for an hour or two to lend the scientist perspective. They support the content knowledge development and also can lend advice about the application of any lessons to current local practices in science. Over the last 15 years and again recently, the partnering scientists worked with GEMS-Net staff to review potential new curricular materials. The most recent review was to find a program that best supports the Next Generation Science Standards (NGSS). The partner scientists focused on the strength of the science for each program under consideration. Ultimately their professional opinion helped GEMS-Net staff advocate that all nine districts adopt FOSS Third Edition and to move away from their current hybrid program that includes FOSS and other resources.

This partnership is mutually beneficial. At every training the URI scientists are seeing excellent pedagogy modeled and as a result, many of the URI professors have confirmed that GEMS-Net educators have directly influenced their practice. They are incorporating more hands-on science and sense-making strategies into their own class structure at the university level.

Teacher leaders, practicing teachers who are very knowledgeable about specific modules, join every module training. They bring a lot of credibility to the trainings because they have expertise about the module and are currently classroom teachers in the trenches. GEMS-Net leaders know that after one full year out of the classroom they begin to lose touch with the pulse of the classroom. As professional development providers, they are aware that they’ve been out of the classroom for many years and sometimes may try to promote something that does not fit within the reality of the school day. Practicing teachers are in every workshop and are encouraged to speak about their direct experiences with things that work because they have tried them and can share effective strategies for dealing with how things will really work in the classroom.

Another component of the GEMS-Net program is that it has full-time Teachers in Residence. These teachers come out of the classroom for two years, receive extensive training, attend most teacher trainings in supportive roles, and help out in a variety of ways. They receive a thorough orientation to the K–8 curriculum and when they return to their schools, they become the “go-to” people in their districts. Several of the current superintendents, district leaders, and principals in the nine GEMS-Net districts served as Teachers in Residence at one time.

GEMS-Net team members emphasize research-based practices in everything they do. “Ongoing professional development” is promoted as essential in almost every research article about improving pedagogy. Although many tout the benefits of this approach, in reality this practice is virtually non-existent. It takes money, time, and commitment. The GEMS-Net organization is able to provide authentic ongoing PD to educators in multiple formats: summer institutes, workshops during the academic year, district learning communities, leadership sessions, and in-classroom coaching. A few weeks ago a GEMS-Net teacher came into a workshop and said, “This is the 27th full-day GEMS-Net PD I’ve been to and I am happy to be here and am ready to learn.” The organization receives almost daily emails from teachers and principals who see GEMS-Net staff as partners in education. PD is ongoing for all teachers whether they expected it or not. Many teachers are eager to come to PD sessions, they are confident that they are going to develop the knowledge and skills they need to thrive in the context and reality of their own teaching situation.

Successes
GEMS-Net has had multiple opportunities to demonstrate its effectiveness and has shown success by tracking student scores on the state science assessment. Graph 1 and Graph 2 [see page 8] show how the students who receive support from the GEMS-Net project compare with students from similar socioeconomic schools on the state science test over the course of six years for grade four and grade eight. The results are statistically significant.

A URI research project assessed teachers’ science content knowledge and fidelity of inquiry practices. It found that teachers in GEMS-Net districts were more likely to teach accurate content and to use the practices recommended by educational policy and research. The project involved a 14-member expert panel of superintendents, principals, state education officers, and university professors and scientists who reviewed 81 videos of lessons. The comparison of data between teachers with kit materials and an ongoing professional development program versus those without were significant.

Graphs 3 and 4 show the percent accuracy of GEMS-Net teachers’ practices and content knowledge compared to teachers outside the GEMS-Net districts. Graph 3 is based on data published in the article titled, Factors influencing science content accuracy in elementary inquiry science lessons. (Nowicki, Sullivan-Watts, Shim, Young, & Pockalny 2013).

How did participating schools achieve these higher performance indicators? All stakeholders, including superintendents, principals, and teachers, make a
commitment to supporting effective practices, such as teaching science four to five days per week. Guidance is provided to teachers about how the five days can be used. Most often two days are active hands-on sessions; another two days focus on teaching students to communicate their sense making and/or reading informational texts related to active learning; and the fifth day may be used for reflection and/or assessment.

Several years ago GEMS-Net principals requested information about how to look for evidence of effective practices as well as how to identify teachers who need additional support. GEMS-Net dedicated time during principal workshops to determine what to look for in classrooms that exemplified evidence of non-use, or educators who are slow to get started.

Some indicators of educators who may need encouragement were listed, and included things such as unopened kits in the hallways, perfectly organized kit boxes, and science notebooks that all look the same—examples of simply copying down what the teacher said. GEMS-Net trainers help teachers to dig deeper to see independent thinking by incorporating the use of sentence frames such as, “I think this happens because…” or “It reminds me of… because…” These are examples of frames that lead to diverse notebook entries that help teachers see what students are thinking and are clues to leaders of excellent science pedagogy in action.

Rhode Island was the first state to adopt NGSS, and the integration of Common Core and NGSS makes a lot of sense. Reading and writing are information-centered activities. When students read and write about familiar science information they are invested. GEMS-Net trainers teach educators how to teach expository writing. Similar to the learning cycle of the investigation they have four phases of teaching students to communicate. Students begin by talking a lot, then teachers model the writing process, then some more talking and processing, and finally students write. Most of the expository writing that students do is in science, and teachers are finding the writing process to be so effective they are now using it in all subjects. Teachers are instructed to be thoughtful about what they ask students to write about and to make sure it is based on what they know about how
children learn. The integration of writing throughout the whole FOSS Third Edition program aligns well with the goals and aspirations of the GEMS-Net team.

FOSS in the Classroom
GEMS-Net staff coach their teachers to do certain things with every active FOSS session. Teachers help students analyze the focus question as it is introduced, asking the children questions such as, “Are there any special science terms that we need to make sure we understand before we answer the question?” They regularly ask, “How can we use these materials to find the answer to our question?” Teachers are also advised to not use the student sheets, but to instead ask students, “How can we organize our data in our notebooks so that another student or scientist can understand what we observed?” Science lessons differ from lesson to lesson but all lessons include engagement with a focus question, active exploration with materials, shared reflection to make meaning of data, and application to apply learning to a bigger picture. Staff encourage teachers to spend a second day with every active investigation, offering students more opportunity to think, talk, listen, and write about the lesson. Separating the days helps students adjust their expectations and behaviors so that they can get more activity on the first day and more focused talking and writing on the second day. The process of learning to communicate science and engineering understanding uses strategies developed by Betsy Fulwiler (Writing in Science, 2007).

Expenses
The districts generally have three expenses. The first is curriculum materials, including purchase and a refurbishment or lease plan. Second is the GEMS-Net membership fee, which includes all professional development for all teachers, principals, and other staff (such as music, art, physical, and special educators). It includes mandatory workshops and classroom coaching. Finally, the districts commit to mandatory workshops for all teachers and cover the cost of substitutes for participating teachers.

In conclusion, GEMS-Net and FOSS share many core beliefs. Most importantly we understand that implementation has a beginning but no end, nor does it have direction—neither top down nor bottom up. To be successful an implementation plan must be guided by all stakeholders. One sure sign of effective implementation in GEMS-Net districts is that the teachers come to mandatory PD sessions and so do the principals and even the superintendents. Some districts joined GEMS-Net because the superintendent thought it was the right thing to do, whereas other districts came in because the teachers advocated for it. Regardless, all the educators come to embrace the thoughtful well-designed curriculum and entire GEMS-Net program because partners are supported in understanding and utilizing the curriculum. Most GEMS-Net educators “buy-in” when they see the effect on students, whether that effect is visible in test scores or in the students’ pure joy when they shout out, “I discovered something!” Implementation is hard work and is much more effective when the time frame is at least a five-year plan. School systems are in continual reform, teachers come and go, administrations come and go, policies come and go, new research informs our thinking about practice, and even science makes new discoveries. Implementation needs to be open-ended. Sara Sweetman reflects,

When I look back at 17 years of GEMS-Net implementation I see a snow ball rolling down an endless hill gathering snow in the form of expertise, experience, and knowledge as it goes. Looking downhill while riding the snowball can be scary. We are beginning to embrace NGSS which adds another color to our implementation spectrum. Together with the FOSS Third Edition, our village of dedicated educators, and our sturdy partnership with the university and the school districts, we will continue to bridge the gap between research and practice to reach our goal of a K–16 STEM pipeline.

The values embraced by GEMS-Net are ones that FOSS admires and hopes can be replicated in other states. FOSS is honored to be a part of the impact GEMS-Net continues to have on STEM education.
In a wonderful blend of art and science, nationally syndicated Stone Soup creator Jan Eliot depicts her character Alix, a young girl and “budding” scientist, innocently releasing an invasive crayfish into the wild. The comic strip series recently featured in a Science News article discusses the consequences of releasing nonnative organisms on the fragile balance between organisms in the environment (Figure 1). The main characters include Alix, a red swamp crayfish native to Louisiana named Pinchy, her science teacher Erma, and Alix’s grandma. The story follows these characters from when Alix finds a crayfish in a lake during a camping trip, brings it home to raise in her family’s bathtub, and names it Pinchy, only to experience that she could not keep Pinchy in her bathtub indefinitely. Thinking that it was the right thing to do, Alix and her grandma innocently released Pinchy into their neighborhood stream where Pinchy becomes invasive, so Erma the science teacher helps Alix and her grandma learn an important lesson on the impacts of releasing invasive species.

The dilemma on what to do with classroom pets or organisms after completing their use in activities or when the school year recesses are familiar experiences among teachers in many classrooms, including those who use the Meet the Crayfish activity in the FOSS Structures of Life Module. Meet the Crayfish is an engaging and effective investigation that connects students to the structures, functions, and behaviors of crayfish and the environments they prefer. Learning with live organisms, such as the crayfish (also called the crawdad), are vital to helping students understand science, and stimulating inquiry to the world outside of the traditional classroom. Yet, after the lesson, teachers must decide what to do with the organisms, and it is important that they have institutional support and options to make informed decisions.

Schools as a Pathway for Invasive Species!

The strip’s storyline is built around a binational (United States and Canada) study led by the Oregon Sea Grant College Program on classroom activities and the release of living science projects and pets into the wild as potential sources of invasive species. Presented at the Ecological Science Society of America’s annual meeting in 2012, the study surveyed more than 2,000 U.S. and Canadian teachers and found that at least one out of four teachers who have live plants and animals in their class eventually release them into the wild (see Figure 2). The study highlights how valuable classroom organisms are, but also the dilemma on what to do with the organisms when the investigation ends.

What Are the Impacts of Invasive Species?

It may seem unrealistic that one crayfish can decimate an entire native crayfish population in a creek, like Pinchy did in the story. Yet, in reality, it isn’t much of a stretch. Classroom pet releases in the real world can cause damaging effects as seen in the storyline of Jan Eliot’s comic. Preventing further damages from invasive
species can lead to expensive control; for example, removing Rusty Crayfish from five small ponds in Wyoming cost more than $34,000 in 2008. Once released into the wild, crayfish are especially hard to control due to their small size, robust reproductive potential, and resilience. The comic strip characters found that the crawdad was actually a “crawmom” and was pregnant, so Pinchy could have made an even larger impact in the creek if she had a chance to release her eggs. Notably, female crayfish can store sperm after mating for a substantially long time, so even if only one female is introduced there is still potential of reproduction. When her eggs are ready, a female can release 200–800 fertilized eggs per brood, potentially resulting in an infestation. Oftentimes nonnative crayfish invasions become so extensive that the costs to control them would be prohibitive and would have collateral harm to native organisms. Such is the case in Arizona, many parts of the west coast, the Southwest, the Great Lakes, and the Northwest. In California, most of the populations of native crayfish have been decimated by nonnative species.

The release of classroom pets and living science projects is an emerging issue. Although the comic characters Alix and her grandmother initially felt it is the right thing to do, they, along with us, learn that releasing pets can cause harm to other species and even cause harm to the released organism. Teachers should be aware that many common aquatic plants and animals can become invasive when released into the wild. Even if the plant or animal is native to the region, it may carry diseases and should never be released. Remember, don’t let it loose!

Potential negative effects of invasive species include:
- degradation of aquatic habitats
- competition with desirable native species
- biodiversity decrease
- alteration of food chains
- introduction of diseases
- limitation of recreation
- damage of infrastructure; and
- contamination of water resources.

Deriving Solutions in the Classroom
Since many classrooms use live organisms to enrich lessons and activities, teachers and families have a crucial role in raising awareness about the impacts of invasive species and actions that can be taken to prevent their spread. FOSS teachers can gain ideas on learning extensions for integrating invasive species into their classroom activities (including FOSS) through multiple avenues. One example is the Watershed and Invasive Species Education (WISE) teachers professional development program of Oregon, Washington, USC and California Sea Grant College Programs. WISE provides teachers with numerous resources to aid in science learning extensions and community stewardship. WISE uses invasive species and watershed themes to work with their students and institutions in deriving solutions on the disposition of live organisms in the classroom activities. The WISE Pledge Form for teachers, students, and parents to sign encourages proper care for and disposition of classroom organisms. The WISE program has a beta-version toolkit that teachers can use to supplement their classroom learning using invasive species

Continued on page 12

Figure 3: Students in Heidi Lent’s Warrenton Middle School class demonstrated their knowledge of invasive species by creating a comic strip. How does the outcome of the student’s comic show the level of learning achieved, and create an opportunity for feedback?
education through lesson activities and other materials. Heidi Lent, a teacher at Warrenton Middle School in Oregon, recently tested a WISE lesson plan activity developed by Linda Chilton at the University of Southern California Sea Grant, using the recent *Stone Soup* comic series (see item 4 in “Useful Resources” on this page). Lent’s students had already researched and written a five-paragraph essay about invasive species, so they were able to apply the knowledge they had learned to Jan Eliot’s *Stone Soup* comic series on the topic. Through this activity, Lent’s students integrated the science they learned about invasive species into a cartoon strip (see figure 3 on p. 11).

The issue of invasive crayfish species and their potential release from schools was a theme on Public Broadcasting Service (PBS) through an Oregon Field Guide documentary “Classroom Culprits” that was aired in 2011. The documentary shows scientists, educators, and students discussing the appearance of the rusty crayfish, native to the lower Ohio River and was discovered for the first time in water bodies west of the Rocky Mountains. Classroom releases were determined to be the source of these crayfish.

Jan Eliot’s comic provides FOSS teachers with a unique new learning extension for the FOSS curriculum where students can learn through the comic strip and an accompanying lesson plan that incorporates art, science, and decision-making. Based off of Eliot’s own interest in ecology and marine biology, Alix is a young biologist-in-the-making whom many students will be able to relate to. Children her age will take from the story a sense of delight and new knowledge that they didn’t already have about crayfish and invasive species in general. By incorporating the WISE lesson plan using Jan Eliot’s *Stone Soup* comic strip and the resources below as an extension to FOSS, teachers can enrich student critical thinking, science learning, research skills, decision-making and conveying concepts and ideas through visualizations.

**Useful Resources**

1) **Comic Artist Brings Invasive Species to the Funny Pages**


   a) GoComics
   
   Read the full crayfish comic series, which ran from July 31-August 3, 2013 and from September 3–14, 2013. [http://tinyurl.com/GoComics-Stone-Soup](http://tinyurl.com/GoComics-Stone-Soup)

   b) Learning extension to Jan Eliot’s Stone Soup comic series, developed by the West Coast Sea Grant Watershed and Invasive Species Education program. [http://tinyurl.com/sea-grant-plants-and-animals](http://tinyurl.com/sea-grant-plants-and-animals)

3) **Watershed and Invasive Species Education (WISE)**

The West Coast Sea Grant WISE program is dedicated to helping teachers learn about emerging watershed issues, which can be used as tools to engage students in science learning and community action. [http://seagrant.oregonstate.edu/invasive-species/wise](http://seagrant.oregonstate.edu/invasive-species/wise)

4) **Aquatic Invasive Species toolkit for teachers including comic strip lesson plan**

The Aquatic Invasive Species toolkit is a set of lessons and activities that build on STEM (Science, Technology, Engineering and Math) principles and are designed to help kids understand what invasive species are, how they affect the environment, and what we can all do about them. [http://seagrant.oregonstate.edu/invasive-species/toolkit](http://seagrant.oregonstate.edu/invasive-species/toolkit)

5) **PBS OBP Oregon Field Guide: Classroom Culprits? Invasive Crayfish Threaten Western Waterways Documentary**

Vince Patton of Oregon Public Broadcasting’s Oregon Field Guide reports on the threat posed to western waterways by invasive crayfish from the eastern U.S. that had been shipped to elementary schools for biology classes and later released where they don’t belong. [http://tinyurl.com/PBS-classroom-culprits](http://tinyurl.com/PBS-classroom-culprits) [http://tinyurl.com/OPB-Crayfish-Invasion](http://tinyurl.com/OPB-Crayfish-Invasion)

6) **Nab the Aquatic Invader**

The Illinois-Indiana Sea Grant provide many classroom activities and games that teach students about nature and inspire them to help the environment by “nabbing” the pesky critters. [http://www.iseagrant.org/nabinvader/index.html](http://www.iseagrant.org/nabinvader/index.html)

7) **FOSS Policy Statement on Living Organisms in the Classroom**

FOSS Science Curriculum explains a clear and detailed list of expectations of treatment of classroom organisms and provides a statement against their release. [http://FOSSweb.com/plant-animal-care](http://FOSSweb.com/plant-animal-care)

8) **Frequently Asked Questions about Invasive Species**


9) **Oregon Sea Grant Website: Information and Resources about Live Plants and Animals in the Classroom**

Oregon Sea Grant makes multiple resources available for teachers to use in preparation for the use of live plants and animals in the classroom, including alternatives to releasing them into the wild after the lesson. [http://seagrant.oregonstate.edu/invasive-species/classroom-plants-and-animals](http://seagrant.oregonstate.edu/invasive-species/classroom-plants-and-animals)

Here are some selected resources available on this site:

- Adopting a Classroom Animal: Pledge-Form/Care-Sheet - A Pledge Form for teachers, students’ and parents to sign to ensure proper care for and disposition of classroom pets.

- Don’t Let It Loose Poster - This colorful and engaging poster illustrates multiple ways to prevent the release of classrooms species and possible alternatives that teachers should use.

- National Classroom Guidelines for Preventing the Introduction and Spread of Aquatic Invasive Species

10) **Share your experiences!**

Have you integrated a learning extension about invasive species into your FOSS activities? Or been faced with the dilemma of what to do with unwanted classroom plants and animals? Please tell us your story! [http://tinyurl.com/classroom-plants-and-animals](http://tinyurl.com/classroom-plants-and-animals)
Research has shown that frequent formative assessment is a key to improved learning (Black and Wiliam, 1998; Wiliam, 2011). But developing prompts, analyzing test data, and developing next-step strategies can take a significant amount of time. Enter FOSSmap.

FOSSmap, the FOSS assessment system online computer program, provides an easy way for teachers to record evidence about student progress for each part of every investigation. Evidence can come from student notebooks. The science notebook is an important part of teaching FOSS Third Edition, and it is also an important authentic artifact for assessing students on a frequent basis. Suggestions for which notebook prompts to use to make students’ thinking visible are in the Getting Ready section of each FOSS investigation part. The Guiding the Investigation section tells you where the assessment is embedded in each lesson and what to look for when you review student notebooks after class.

Why is frequent data so important? Dylan Wiliam provides a great analogy by comparing assessment to taking a trip on an airplane. When you get on the plane, you expect the pilot to take off and aim the plane towards the destination, but you also expect him/her to be checking the flight path frequently along the way. You would not want to be on a plane in which the pilot pointed the plane in the right direction, but then didn’t check the final destination until after the plane had completed the allotted flight time. Wind currents and other variables affect the path of the plane along the way. If the pilot didn’t check frequently, you would most likely end up somewhere you didn’t want to be. The same thing can happen in instruction.

FOSS has developed a formative assessment process called Reflective Assessment Practice. The idea is that you spend 10 minutes after each investigation part reviewing student work, as suggested in the Investigations Guide. (Ten minutes is what ASK Project teachers told us they could devote to science assessment on a frequent basis. Armed with this information, we conducted a small study as a part of the ASK Project to find out if 10 minutes of review could make a difference. We found out that it can, up to a 30% difference on the posttest. See “FOSS Assessment Corner,” FOSS Newsletter, Fall 2013 for more information on the ASK Project.)

As you review students’ work—reading an answer to a focus question, reviewing a response sheet, for example—you simultaneously go online to FOSSmap for that embedded assessment and enter reflections in the “add notes” page for that investigation part. You will find that all of the students are checked off as “got it!” The reason for this is time. You know that every keystroke taken to record that a student “got it” takes a few seconds. In our studies we found that students more often than not did get it, so to save time the system is set up so you only have to uncheck the box if a student didn’t get it. Then you can write a short note to
describe the problem as well as type a sticky note to print for that student.

When you have reviewed the work, you reflect on patterns of learning you noticed for the class in general and record those in a textbox below the student data. This is a great place to keep notes about what you did to help students move forward if they were having problems or to make notes about how you might do things differently next year. When you’re finished recording data, notes, and reflections, you can print out the embedded assessment report, as well as sticky notes for selected students or all students. There is a default sticky note in the program for students who did not get it. (You entered customized text to provide sticky-note feedback to help students who did not get it.) Reports are archived online for five years and provide an excellent resource to contemplate and improve instruction from year to year.

When it’s time to take an I-Check, FOSSmap has been designed (Third Edition only) to allow students to take the assessments online. The program records students’ answers as well as automatically codes students’ answers that are responses from multiple-choice or multiple answer questions. FOSSmap also codes student responses to short answer questions. FOSSmap can interpret short answers that are spelled correctly, and those that are close approximations, but can’t always give credit for all the ways students invent spelling. You’ll want to spot-check short answer responses.

Teachers must code the open response items, but if students took the assessments online, the responses are all displayed on one page with a coding guide to make it easy for the teacher to read them one right after another. If students take the benchmark assessments offline (using paper and pencil) you will need to enter their codes by hand into the FOSSmap system in order to generate reports. If you are a Second Edition FOSS user, you will need to enter codes by hand for all items.

Another of the beauties of FOSSmap is the array of reports that you print for your students, yourself, families, and administrators. Here’s the sequence we recommend for looking at reports.

**For the Teacher**

After entering data for a benchmark assessment, print the **Code Frequency Chart** first. This may look a little intimidating, but it’s actually very simple to interpret. You only need to pay attention to the colored bars. There is one colored bar for each item. That bar will be green, yellow, or red.

- A green bar indicates that at least 70% of the students got the answer correct.
- A yellow bar indicates that between 50 to 70% of students got the answer correct.
- A red bar indicates that 50% or fewer of the students got the answer correct.
- The red bars identify the problem areas you need to help students with their understanding.
- The black bars indicate the percentage of students who received codes below the highest possible.

The **Class By Item report** provides the detail you need to determine what students need help with. The items on this report are ordered by concept and then by item difficulty. There is a narrative description for each code and each item that will tell you what each student knows...
or needs help with. This report can help you determine items that need some self-assessment reflection with students.

For Each Student
There is a Student by Item report available for each student after each benchmark assessment. This report shows correct answers, student answers, and a description of what this shows students know or need to work on. This is a report that parents love because it gives them information about what their child knows and needs to learn.

There are six reports in all, and you can go to FOSSmap.com to see them for yourself.

When you’re ready to dive into FOSSmap, first, and foremost, take the time to go through the tutorials found on the FOSSmap.com home page. These tutorials explain in great detail how to use all aspects of FOSSmap. Although the program is quite intuitive and easy to use, spending a few minutes on the tutorials can save you time and frustration as you start using the program.

As always FOSS staff are here to help you if you run into any problems or have questions about using the program. You can email me directly at klong@berkeley.edu or you can email the FOSSmap programmers directly at the help email provided in FOSSmap itself.

We hope everyone will give this new aspect of FOSS a try and send us feedback.

All feedback is welcome. As with all new programs, there may be a few glitches along the way. The only way we can fix those in a timely manner is to hear from you! And of course, we want to hear your success stories as well!

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FOSS Goes Local: State Specific Resources Now Available on FOSSweb

By Karen Mendelow Nelson, FOSS Curriculum Specialist

While you are together with your class investigating the activities in FOSS modules, students will often come up with “I wonder” questions. Of course, teachers wonder things too. What watershed are we in? What is this local tree? Are there composting resources for me as I begin this new schoolyard project? What field trip spots might be a great match for this module? Students begin to make connections and ask questions about what’s happening in their local landscape, building upon module explorations, schoolyard experiences, or places that they have visited in their local community.

FOSS is proud to announce that we have collected some of the best online resources available so that you can inquire about your own regional environment during each FOSS module. These links are available on FOSSweb to help support and extend FOSS module content, scout field trip locations, bring outreach opportunities to your school, connect with experts, find local support, and explore outdoor or schoolyard resources.

FOSS supports the development of green schoolyards and enthusiasm for outdoor learning. We set a goal of doing the online research to support teachers by gathering resource links that relate to FOSS module core ideas. To access these resources on FOSSweb, you can either log in to your account, or visit as a guest by selecting your role, state, and applicable grade level(s). Find the module you are using and to go to the “Digital-Only Resources” section at the bottom of the page, then click “Regional Resources.”

You can find links to things such as backyard wildlife; state wildlife including mammals, insects, trees and other plants; places to go on field trips; the best places to observe wildlife; local watersheds; astronomy; weather; geology maps; and much more. Outreach programs that visit school sites are also highlighted.

Field trips opportunities to local science museums are available by searching the state within nationally based organization home sites. The majority of the resources are supporting the life and earth science modules, but they support physical and space science as well.

Local resource opportunities reflect and reinforce classroom content by engaging students in real world applications, with opportunities to engage in scientific practices such as communicating, writing, and presenting information. Students can take a bit more time to reflect on the connections they have made from classroom information to natural and human-created environments.

Use the FOSS regional online resources for social and hands-on projects. Groups of students may want to share local information about how their questions relate to the science concepts explored in FOSS or perhaps to extend content using data available through state resources, parks, water and natural resource agencies, and community groups.

So as you post your students’ “I wonder” questions that come up in class in the “Parking Lot” for later study, encourage students to conduct further research or take a field trip. Let us know at FOSSweb how you make use of the online FOSSweb compendium of state resources. And if you have a resource to add to our database, send it to foss@berkeley.edu.

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FOSS Newsletter, Spring 2014, No. 43
A Framework for K–12 Science Education identifies three dimensions of the science education enterprise—three instructional/conceptual arenas in which our students should be facile and competent. The scientific and engineering practices are familiar and pretty easily incorporated into our vision of the expectations for student accomplishment. Easy for FOSS; after all, the practices are what for decades we attempted to represent and accomplish with the ill-defined word inquiry. (Thank you Framework, for clarifying that.) The disciplinary core ideas are the scientific knowledge that we were comfortable referring to as science content—that which we felt confident we could communicate to students on a need-to-know basis. And finally, there are the crosscutting concepts, variously referred to previously as the unifying principles, themes, or big ideas of science. With the release of the Next Generation Science Standards (NGSS), we see that for students to demonstrate science competence, they will be expected to exhibit command of the subject that communicates the interplay of scientific/engineering practice, disciplinary core ideas, and crosscutting concepts.

Now here is the rub. We know some stuff about how the student mind grapples with and makes sense of things they learn. Essentially, small bits of learning (information) are cobbled by still-somewhat-mysterious processes into complex chunks of learning that we call knowledge. Knowledge must be constructed by the learner. As educators we can provide the context, opportunity, and encouragement for students to engage in the sometimes painful process of constructing knowledge, but we can’t teach it. We sometimes call this “sense making,” and it is rigorous cognitive work that must be undertaken by students.

Knowledge is a pretty high order of cognitive achievement, but it is only a stepping stone to the next level of learning. The gold ring that we want students to strive for is understanding. Understanding gives knowledge far ranging power. Understanding puts learning into juxtaposition with the nature of science. Understanding a topic gives the “understander” a sense of connection to context. The learner can say to himself or herself, “I now see how this system or situation works and how it can be influenced by this, that, or the other variable.” Understanding gives you confidence that your knowledge is useful and that it gives both insight into and reliable information about the world.

So how should we think about the crosscutting concepts? As more content to be taught in information bits, or should they be herded into the deep end with the other knowledge that must be constructed? Well, the answer is probably yes and yes. The crosscutting concepts are those really big conceptual threads that run through and among all of the sciences. Look at the list and you’ll see what I mean.

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter: flows, cycles, and conservation
- Structure and function
- Stability and change

As suggested in the Framework, these crosscutting concepts have powerful connections between all disciplines at the advanced levels, but what do we expect 5, 6, 7, and 8 year olds to apprehend with regard to these monster concepts? Is there a progression of complexity through which we expect students to advance as their science studies progress? Certainly, but what is that progression? Too little research has focused on this area of cognitive growth; too few beacons for us to navigate by. But common sense and experience suggest that some early exposure to this vital connective tissue in the body of scientific knowledge would be appropriate.

For example, in kindergarten, when students are learning their basic shapes, we can introduce the shapes as patterns (a vocabulary introduction): square, circle, triangle, star, heart, etc. Then on a schoolyard field trip, you can mount a leaf hunt. Back in the classroom, debrief with a discussion about the patterns of the leaves. What pattern do they most resemble? Which pattern was the best representative of the greatest number of leaves? You might make a bar graph (scale, proportion, and quantity)
representing the distribution of leaf patterns; possibly discovering that there are many more star-pattern leaves than square-pattern leaves. On your next field trip, when your goal is to inventory the different kinds of trees, students should be encouraged to make field sketches of their favorite tree in their science notebooks. Sketching calls on students to recognize a tree as a system—a set of interacting parts—including a trunk, branches, twigs, and leaves, possibly with the addition of flowers, fruit, and bark as additional components of a tree system. Sketching is a first step toward constructing a model of “treeness” (systems and system models).

In third and fourth grade, when students study crayfish, they are invariably fascinated by the pincers. Why do crayfish have those dangerous looking structures? Perfect time to introduce the vocabulary and concept of structure and function. And once students have had time to engage in a lively discourse about why crayfish might have pincers (defense, feeding, warning), a schoolyard field trip might provide opportunities to transfer the structure/function concept to other organisms or structures in the environment. A bird or squirrel might stimulate a good discussion, as might a question about the school building itself. You can point to and identify the steps, doors, and windows as school building (designed/engineered) structures and let students suggest functions to assign to each.

In fifth and sixth grades, students might investigate the interaction between solid materials and water. Students will observe that common table salt added to water results in an interesting situation; the solid salt disappears in the water. A minor mystery. A balance can provide evidence that the salt is still there, but is invisible; changed, but not lost. Evaporation of the solution brings the tangible solid salt back (stability and change).

The mini vignettes described above provide contexts in which crosscutting concepts can be introduced and made explicit (taught). But their power is not fully realized until students engage in their more advanced studies in middle school, high school, and university. When understanding of the crosscutting concepts achieves maturity through application and practice, they evolve into a set of cognitive lenses through which the entire universe is viewed. How else can a person think effectively about entities as diverse as the cosmos, climate change, evolution, sustainable energy, Earth history, ocean ecosystems, and Monarch butterfly migration. They all jangle the crosscutting concept nerves.

It seems to me that the essence of scientific literacy is the ability to experience all of science as a single fabric woven of multiple threads of different hue and heft. The crosscutting concepts are the lenses that allow the threads (disciplines and practices) to be appreciated as a beautiful, functional, unified fabric. Acquiring those crosscutting lenses is a joyful journey of a thousand kilometers, and the first steps are easy with the guidance of a FOSS teacher.


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### Remembering Terry Joe Shaw

**By Larry Malone and Linda De Lucchi**

On December 21, 2013, the FOSS family suffered a heavy loss. Dr. Terry Shaw died after a courageous six-year struggle with cancer. Terry was born on January 20, 1947, in northern Oklahoma. He grew up son of a wheat farmer, and attended school in Burlington, Oklahoma, where he graduated valedictorian in 1964. Not destined to devote his life to the soil, he entered Oklahoma State University where he earned his BS degree in biochemistry. Terry then migrated to California here he earned his MS in molecular biology at the University of California at San Diego while doing cancer research at the prestigious Salk Institute. After that pursuit, he moved to Arizona where he had his first experience teaching school science and was voted the Litchfield teacher of the year in 1973. Following the tragic loss of his first wife, Terry returned to Oklahoma where he earned his PhD in science education from Oklahoma State University (1973–77). In 1975, Terry remarried, and he and Thelia raised two children, Tarren and Tana, while Terry taught middle school science at Stillwater Middle School and Irving Middle School (Norman). Terry was an assistant professor in the Department of Curriculum and Instruction at Kansas State University starting in 1979 and was tenured in 1983, but he missed the excitement of working with younger students and chose to follow his passion into the middle school classroom.

In the mid 1990s, NSTA conferences caused our path and Terry’s to converge. A somewhat random conversation began and ranged widely, including fragments touching on curriculum development, classroom practice, digital technology in the middle school curriculum, and outdoor experiences in middle school science. (Terry was one of a handful of public school educators who knew and used OBIS activities from the Lawrence Hall of Science in his practice.) Over a number of

*Continued on page 18*
encounters at various NSTA conferences, the conversation expanded and intensified. We were drawn to his warm personality, depth of classroom experience, and wealth of ideas and boundless creativity. The conversation naturally progressed to the possibility of a career change: FOSS curriculum developer.

In June 1997, Terry and Thelia made an exploratory excursion to Berkeley, California, to survey the work environment and meet with us and Dr. Susan Brady. Terry found the circumstance acceptable, and in the fall, we negotiated a release agreement with his district so that Terry could relocate to Berkeley. Thelia secured a position as a school counselor in West Contra County USD and the family plan was set. In September 1997, Terry loaded his old pickup and motored to Berkeley where they had secured an apartment. That first night after moving in, his truck was stolen (welcome to Berkeley), never to be seen again. After that rocky start, Terry settled into his new routine as a full-time science curriculum developer. At the end of the first year, we renegotiated the release agreement and Terry continued for a second year in Berkeley.

After completing his second year at the Lawrence Hall of Science, Terry found it necessary to return to Oklahoma to attend to family obligations, and to resume his classroom responsibilities at his school. After completing one last year in the middle school classroom, he retired. Terry continued to work for FOSS on a part-time basis, doing mostly professional development work around the country. During this time, Terry also cared for his wife Thelia, who died of leukemia in 2005. In the summer of 2006, we recruited him to again assume full-time work as both a professional development specialist and a curriculum developer, which he did with amazing energy and grace right up until the end. Anyone visiting Terry at work found him in his large home basement office, surrounded by FOSS boxes and critters.

The beginning of 2007 found Terry married to Skye Diers, owner and director of the Gingerbread Preschool in Norman. Terry fell in love not only with Skye, but with all those 3–4 year olds who played and worked so creatively in the wonderful indoor and outdoor environments.

Terry was an active member of NSTA throughout his career as a member of the middle level committee, and served on other committees dealing with awards, convention planning, and instructional models supported by technology. He presented over 80 sessions at NSTA conferences on environmental education, designing inquiry oriented earth science and life science curricula to address misconceptions, improving the attitudes of at-risk students toward science, and developing middle level science teacher education programs. He was meticulous in his preparation for these sessions, and presented them with passion as he engaging the participants in the hands-on inquiry that he loved.

He wrote and received numerous grants for special projects, but the one that was most important to him was the TAPESTRY Grant in 1994 (Toyota and NSTA sponsored) for $10,000 to support a student project to increase the reproductive success of the interior least tern in Oklahoma, an endangered species.

Terry’s outstanding contributions to science education were recognized at the local, state, and national levels. The honors that were most dear to him included:

❖ The National Environmental/Conservation Teacher of the Year by the National Association of Conservation Districts, 1978;
❖ The Outstanding Teacher of the Year at Oklahoma State University (OSU), 1979;
❖ The Outstanding Middle Level Science Teacher in the State of Oklahoma, 1988;
❖ The Presidential Award for Excellence in Science Teaching, 1992; and
❖ OSU College of Education Hall of Fame induction, April 2013.

Terry was one of those exceptional people who we are privileged to meet a time or two in a lifetime. He was just flat out good in every way imaginable; reliable, interested, interesting, supportive, brilliant, patient, fun-loving, curious, mischievous, analytical, reasonable, compassionate, courageous, resilient, and a good friend. Terry has returned home to take his rest in the fertile soil in the Keith Cemetery, surrounded by wheat fields, within view of his family farm. His matter has departed the company of the FOSS staff who loved him dearly, but his spirit hovers in and around everything we do and think. God Bless Terry Joe Shaw.

Delma Education has established the Terry Shaw Memorial Scholarship to acknowledge Terry’s dedication to professional development. The teacher scholarship this year is for the middle school Earth History summer institute. For more information about the scholarship, please visit: http://www.FOSSweb.com/Earth-History-2014
FOSS Institutes

Delta Education will host two one-day FOSS Institutes before each of the three 2014 NSTA area conferences in Richmond, Virginia (10/15); Orlando, Florida (11/5); and Long Beach, California (12/5). These Institutes, one for K–5 and one for middle school, will be for educators from districts that have implemented FOSS or are interested in learning about 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 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 or e-mail:

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NSTA NATIONAL CONFERENCE
BOSTON, APRIL 3–6, 2014

FOSS K–8 Commercial Workshop Schedule

Thursday, April 3, 2014
8:00–9:30 FOSStering the Common Core: Science-Centered Language Development
10:00–11:30 Scientific Practices: What Does Argumentation Look Like in an Elementary Classroom?
12:00–1:30 FOSS Assessment Online!
2:00–3:30 Asteroid! Will Earth Be Hit Again? Planetary Science for Middle School
4:00–5:30 Evidence for Plate Movement with FOSS Earth History, Second Edition for Middle School

Friday, April 4, 2014
8:00–9:30 FOSS Assessment Online!
10:00–11:30 Engineering in Elementary Science: Designing with FOSS
12:00–1:30 Let’s Go Outside! Taking Science to the Schoolyard
2:00–3:30 Scientific Practices: What Does Argumentation Look Like in an Elementary Classroom?
4:00–5:30 Addressing Engineering Practices and Design Standards with FOSS Middle School

The Lawrence Hall of Science Institutes
Transferring to Next Generation Science Standards in California July 1–2, 2014
FOSS California Two-Day Summer Institute

FOSS Middle School July 8–11, 2014
Introducing Earth History, Second Edition

The Next Generation of Active Learning

Regional Institutes
Regional institutes for elementary and middle school programs are offered throughout the country. For a complete list of dates and locations, please visit the Professional Development calendar on FOSSweb, or contact Jenn Reid for more information. jenn.reid@schoolspecialty.com

Columbia, SC, June 25–26, 2014
Olympia Professional Development Academy
June 25 FOSS Third Edition for Grades K-6
June 26 FOSS Middle School featuring Planetary Science, Second Edition

Be sure to regularly check the FOSSweb Professional Development calendar for new locations and dates!

For more information about the workshops on this page and other professional development opportunities, visit the FOSS Professional Development calendar. http://www.FOSSweb.com/pd-event-calendar

Please join us as we bid a fond farewell and extend our best wishes to Pam Frisoni, Institute and Adoptions Coordinator, who is retiring after 25 years with Delta Education. For the last 15 years, Pam has been the voice on the phone, the name on the email, and if you were lucky enough to meet her, the face who took care of the many details to organize the FOSS institutes and conference workshops. Pam has also been key in supporting our national network of FOSS consultants. We will miss her “can do” attitude, her wit, and her kind, generous, and gracious nature. Pam and her husband, Frank, are very excited to start the next, relaxed chapter of their lives along a lazy river in Maine. Good luck, Pam!

Sign Up to Receive the FOSS Newsletter
To receive the FOSS Newsletter electronically, sign-up at www.deltaeducation.com/science/foss/newsletter.aspx or send your request to mary.finocchiaro@schoolspecialty.com. Include your name, title, school, and e-mail address. You can also view both the recent and previous issues of the FOSS Newsletter, as well as archived articles, at http://www.FOSSweb.com/newsletter.

If you’d like to be added to the mailing list to receive this newsletter by mail, please send your name and address to:

Mary Finocchiaro
mary.finocchiaro@schoolspecialty.com

http://www.facebook.com/FOSSscience
http://twitter.com/FOSSscience
FOSS provides students with authentic opportunities to engage in scientific and engineering practices.

Get started today with 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.

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