The Shrimp Club Lives On!
By Erica Beck Spencer, FOSS Curriculum Specialist

Has a student of yours ever asked a question so big and so important that everything else had to stop until the answer could be found? Has a question been profound enough to lead to a project that energizes students to show up early and even ask to stay in from recess to do more work? This happened in Laurette Rogers’s classroom in 1992 after she showed her fourth-grade students at Brookside School in Marin County, California, a depressing film about endangered species. The entire class felt helpless and then one of these students asked, “What can we do to help?” At that moment Rogers knew they had to do something big.

FOSS interviewed Rogers and one of her students for an article about the empowering and award-winning Shrimp Club in the FOSS Environments Science Resources book (SRB).

Although the Shrimp Club itself no longer exists, the STRAW Program (Students and Teachers Restoring a Watershed) is thriving, so much so that in March of 2015 they celebrated their 500th restoration project.

Laurette Rogers continues this work as a program of Point Blue Conservation Science, formerly known as PRBO Conservation Science. For more than two decades she and the STRAW team have led students and teachers in restoration projects along 32 miles of creek, with over 38,000 kids getting their hands dirty planting 40,000 native trees and shrubs. These students, from more than 50 schools, joined together with restoration managers, locals, and conservation groups to do the meaningful work to restore habitats but also to feel that they’re doing something to improve the health of the Earth.

Giving students a sense of empowerment when confronting issues about climate change, rainforest destruction, or endangered animals instead of feeling powerless is both hard to do and really important. David Sobel has written extensively about how teachers should avoid the doom and gloom of the world’s problems unless students are empowered to do something about it. Rogers was trying to do good by showing her students the movie about endangered animals, but inadvertently left them feeling discouraged. Her response to do something to empower her students is just what her class needed. In Sobel’s powerful book, Beyond Ecophobia, he writes, “What’s important is that children have an opportunity to bond with the natural world, to learn to love it and feel comfortable in it, before being asked to heal its wounds” (1996, Continued on page 2
Shrimp Club continued

pg. 10). Getting kids outside, doing restoration work, and being a part of something bigger than themselves is an excellent way to help form this nature connection while also affecting authentic change.

In today’s testing and standards driven climate, it’s next to impossible to drop everything and follow students’ leads. But the decades-old question, “What can we do to help?” is still being answered by many, many students through the work that the STRAW Program continues to do. FOSS believes that this level of engagement is part of a formula to change students’ lives. If students are taught our program in the classroom, go to the schoolyard for the outdoor parts as described in the Investigations Guide, and then go to do restoration work, such as that conducted by the STRAW Program, then students will be forever transformed.

Throughout our country there are fine organizations doing citizen science projects that empower students to improve habitats they live in while simultaneously connecting children to the natural world. Here in Maine, one of the many excellent organizations doing this work is the Gulf of Maine Research Institute (GMRI), Vital Signs program. Vital Signs gets middle school students exploring their local habitats, learning about invasive species, and conducting field work to help combat the issue. There are thousands of like-minded organizations like Point Blue Conservation Science and GMRI, wanting to connect with schools because they, like you, want to impact the lives of kids. Reach out to one of these organizations and chances are, they’ll welcome you with open arms. In fact, they’re waiting for you!

For more information about Point Blue Conservation Science, visit: http://www.pointblue.org

For more information about the STRAW Program visit: http://tinyurl.com/straw-program

Watch the trailer for the STRAW Program documentary, A Simple Question, here: https://vimeo.com/7051769

To find local organizations near you, search for your environmental education state organization or go to the Regional Resources section on FOSSweb (under Digital-Only Resources).

References


Assessing Science Knowledge (ASK) and Formative Assessment for Science

The Assessment Corner

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

Formative assessment has become a bit of a buzzword, and like other educational terms it can come to mean many different things. In FOSS, we define formative assessment as a practice or process in which teachers are gathering information about student thinking in order to plan next instructional moves and provide feedback to improve learning. While it is important for teachers to be cruising the classroom and paying attention to what students do minute-to-minute, it’s often not enough to accurately put your finger on the pulse of students’ developing understanding.

While class discussion is a source of important information, we have found that teachers can leave these discussions with a false-positive sense of what learning has actually occurred. Teachers call on two or three students who can state the right answer and assume everyone has that same understanding, or if a teacher is not hearing a “right” answer, she or he will ask questions leading students to the correct answers. All this is part of good teaching, but it does not ensure that every student now understands the concept. In the ASK and FAST Projects, we found that writing and/or drawing something about the concept in question, rather than just talking about it, provided far better evidence of student understanding. Putting their thoughts down on paper gives students another opportunity to process their thinking to determine what they actually know and what they still need practice with or what needs clarification. As one teacher from the Reflective Assessment for Elementary Science project (RAES; see more about this project later in this article) put it,

Students may look like they’re learning when they aren’t actually learning—I now realize that students don’t learn something just because I teach it. Nodding their heads and looking interested are not necessarily indicators of learning. Asking students to write about their learning (in notebooks, RA [Reflective Assessment], exit slips, etc.) makes the learning visible to the individual student and to me. When a student can explain his/her learning in writing (and it matches the target of the lesson), then I can be confident that the intended learning took place.

In the ASK Project, we invented the reflective assessment practice (Kennedy, Long, and Camins, 2009). This came about because we had noticed as we pored over student work in year two of the ASK Project that there were often misconceptions in notebook entries that matched those we were finding on I-Check benchmark assessments.

We had gotten feedback that teachers really loved using science notebooks because it kept students’ work organized, the students felt ownership of their work, and students felt more like real scientists. But when we asked the teachers how often they actually looked at the student notebooks for formative assessment purposes (so they could modify instruction as needed), they sadly shook their heads and admitted almost never. “We don’t have time to read them,” was their universal explanation. Teachers’ general impression was that reading the notebooks would take several hours to evaluate all students’ entries. When we asked them how long they would be willing to spend each day, they said, “Ten minutes.” So we embarked on a little side study to see if spending only 10 minutes looking at student work could make a difference. The result of this study was that 10 minutes can make a BIG difference!

Student Learning Results

Pre to Post Performance (N=295)

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<th>Average Proficiency in Logits</th>
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The Reflective Assessment for Elementary Science (RAES) Project

In 2011, we were approached by Cory Forbes, a professor in the College of Education at the University of Iowa. He was interested in using our reflective assessment practice in the professional development project (RAES) he was putting together with Grant Wood AEA (an educational service agency that serves schools in several eastern Iowa counties). In 2012, the project was funded by the Iowa Board of Regents. The project focused on increasing teachers’ content knowledge and scientific practices as well as formative assessment. For the remainder of this article, I will focus on the results of the reflective assessment practice (formative assessment), even though you could argue that content knowledge, scientific practices, and formative assessment are so tightly interwoven in teaching that it is hard to separate them.

The RAES project was structured so that teachers met seven days over three summers to work on content knowledge, practices, and

*Assessing Science Knowledge (ASK) and Formative Assessment for Science through Technology (FAST) were two grants funded by the NSF that provided the research base for the assessment system now in the Third and Next Generation Editions of FOSS.

Continued on page 4
formative assessment techniques, preparing for a focus module each year (earth, life, or physical science for that year), then met two Saturdays during the school year and 12 times in CTLs (Collaborative Learning Teams) that were facilitated by professional developers from Grant Wood AEA. The 35 teachers who participated in the project were very dedicated educators and provided a wealth of teaching expertise that helped us learn how to support teachers in developing formative assessment practices. This support must be manageable, given teachers’ busy schedules, as well as worthwhile for them to use in other subject areas and share with other teachers.

Here is the reflective assessment practice in a nutshell. Note that the teacher spends only 10 minutes reviewing student work for the whole class.

Finally, you adjust the instruction. This may be as simple as carrying this information into the next day’s lesson, and taking time to clarify as needed when students address similar concepts in that lesson. Or it may mean taking five minutes at the beginning of class to have the class participate in a next-step strategy to help them reflect on their thinking and to clarify possible misconceptions that may be developing. (For more information about the reflective assessment practice, see the Assessment Chapter in any grade 3–8 FOSS module.)

Through the hard work of the teachers and RAES staff, we learned important lessons. Here are the four points that I think are most important in order to fully implement formative assessment through reflective assessment practice.

1. **Belief systems.** In order to see any value in using formative assessment, you must believe deeply that intelligence is malleable. Much work on this has been done by Stanford University professor Carol Dweck and her graduate students. If we believe that students are stuck with a particular amount of intelligence, then there is no point in using formative assessment to help students improve; it won’t help. Given a growth mindset (teachers and students) it is hard work, perseverance, and constant feedback that bolsters students’ achievement, and reflective assessment is a practice that helps make that happen.

2. **Giving students agency.** “Who’s doing the talking? Who is doing the thinking?” I still hear the echoes of the voice of Arthur Camins, FAST Project Co-PI, repeatedly asking these important questions. Part of the success of formative assessment is making students an intimate and proactive part of the system. Assessment can’t be something that is done to students, it must be something in which they play the biggest part. It’s their learning after all that is at stake. And surprising to many, students greatly value the opportunity to have more control over their own learning. They actually put more effort into their learning as classroom culture changes and they find that making a mistake doesn’t mean you’re not smart. It simply means you don’t know it yet. Practice, clarification through student discourse, and teacher’s next-step strategies can all help students get to the learning goal they are approaching.

My biggest aha about formative assessment is that the assessments are not just for me. They are also for the students, and that self/peer assessment can be more powerful for the students than receiving adult feedback.

—RAES Teacher

Students need to be directly engaged in the learning process…the importance of students actually thinking about their thinking and the need to create the time daily to allow students to do this.

—RAES Teacher

FOSS provides support for each of these steps. To **anticipate**, you look at the Getting Ready section of an investigation part. An embedded formative assessment is suggested for each part. To **teach** the lesson, you use information in Guiding the Investigation, including What to Look For, after students turn in their written formative assessment work. To **review** and **reflect** on student work, you collect notebooks open to the page students have written on. You spend 10 minutes after class looking at as many samples of their work as you can, collecting observational data to determine trends and patterns of thinking for the class—what students understand and what clarification they may need.

My biggest aha about formative assessment is that the assessments are not just for me. They are also for the students, and that self/peer assessment can be more powerful for the students than receiving adult feedback.

—RAES Teacher

Students need to be directly engaged in the learning process…the importance of students actually thinking about their thinking and the need to create the time daily to allow students to do this.

—RAES Teacher
3. Ten minutes? How can you possibly learn anything in that short amount of time? Many teachers find it hard to believe that only 10 minutes for the whole class is going to be worth anything—so they never try it. But we have shown time and again that 10 minutes can make a big difference. And it not only makes a difference in terms of student achievement, it makes a difference in a teacher’s confidence that she or he is doing a good job of teaching. Teachers have a much better idea about what the students are taking away from the lessons, and the review time provides valuable information for building their own instructional expertise, for this year and next.

4. It’s hard to stick to 10 minutes for the class. True! Looking at student work is extremely enticing when you are really trying to dig in and understand what students are thinking. So you have to limit yourself to 10 minutes by setting a timer and training yourself to stop! There is a bit of a learning curve to this too. Getting the most out of your 10 minutes means you have to limit your focus, be very clear about what you are looking for (check out the What to Look For sections in the Investigations Guides), and not worry about spelling, grammar, etc. The more you do it, the more you learn to look for the salient points that will help you determine what next instructional steps will be needed. You just have to trust us, for now, that you can learn a lot from that mere 10 minutes and that our research has shown that it makes a big difference in students’ achievement.

Acknowledgements
The RAES project was a great success for the teachers involved in the project and their students. I’d like to thank all those who participated in the project for their insights and continuing enthusiasm. Several teachers have gone on to do workshops and mentor other teachers in their schools and districts. A special thanks goes to the folks who worked directly with the teachers so faithfully: Jeanne Bancroft, Christopher Soldat, Erica Larson, and Mark Brockmeyer. Special thanks, too, to Leslie Flynn who took over the university’s role in the project when Cory was called to the University of Nebraska, and Cathy Kennedy who was our external evaluator and provided valuable feedback and advice throughout the project. And last but not least, thanks to the graduate students who helped with some of the analysis and kept all the data well organized: Mandy Biggers, Jaime Sabel, and Ashley Hansen.

References
Recently I walked into Ryan Kollar’s sixth-grade science class and noticed something strange. It wasn’t the fact that the kids were basically operating the class through concentrated student-led group discussion. It wasn’t the weird diagrams drawn on the board. Nope, it wasn’t even the cockroaches perched on the walls of the aquarium in his classroom. The strange thing I saw was Kollar smiling. He wasn’t just smiling; he was beaming. As Kollar circulated the class and listened to student discussion, he noticed me standing there. He walked over to a stack of notebooks, picked up a hefty handful, and dumped them in front of me, declaring, “Check out these focus question responses!” As I pried open the pages of the books and began to read, I realized how correct and detailed student responses were. Kollar beamed away. This man— who in the last two years of our time working together was the surliest teacher I’d met—was beaming! He and his students were truly enjoying science.
Mastery Charter Schools
Mastery Charter Schools is a 21-school nonprofit network providing access to quality education to over 12,000 students in Philadelphia, Pennsylvania, and Camden, New Jersey. The majority of schools are neighborhood schools, filling seats with catchment students. In a city where education has been gutted by underfunding and underperforming schools are closing, Mastery takes the same kids from the same schools in the same neighborhoods as before, but operates with different management. Mastery strives to serve all of the students in the catchment. The resounding motto at Mastery: “All means all.”

In line with our vision that all students learn the academic and personal skills they need to succeed in higher education, compete in the global economy, and pursue their dreams, we began this year by rolling out FOSS Next Generation as our primary science curriculum in grades 3, 6, and 7 across 13 campuses. The goal is to ultimately take the curriculum to all of our schools in grades 3–8.

The First 30 Days: Implementation
We decided to begin the year implementing Earth Science modules: Water and Climate in grade 3, Weather and Water in grade 6, and Earth History in grade 7. Our goal for the report period was that 90% of teachers execute an appropriate FOSS lesson with accurate content and meet the requirements of the course structure: notebooks, working in collaborative groups, and active investigations. There are currently 23 teachers implementing the FOSS program, 10 in their first year. Needless to say, this was no small task!

Administrators in campuses using the FOSS curriculum participated in a two-day professional development. They experienced a model lesson that shared the vision for the program. This invested the leadership to allow teachers to take a deep look at each investigation with students. For norming and strategic support across campuses, administrators used a common set of rubrics to track student performance with group work and notebooks and provide structured feedback to teachers.

Kickoff
As this was the first time our students engaged with science in this rigorous way, we began with targeted support. Students participated in a week-long side course to develop notebook and group work foundations while planning investigations, collecting data, and graphing. Teachers were trained how to assign roles, monitor group work, and provide feedback to groups to meet the rubric targets. For instance, groups could score up to four points for teamwork and academic language. Teachers rated groups on a scale of 1–4 for each target, shared the score with the group, and told one specific person in the group what behavior to change and how so the team could increase their score. This might sound something like,

*Your team is currently scoring a 2 for teamwork. To get to a 3, we need to get Samara to join the conversation. Khalid, since you’re the Starter, you should begin by asking Samara what she thinks the answer is. Samara, once he asks you,*

you’ll join in by sharing your response. Everyone else, you’ll be actively listening. Samara, do you have an answer ready? Great! Khalid, I’ll watch while you and Samara work through this.

Empowering teachers with a targeted way to provide feedback allowed students to be more accountable to each other and invested them in this challenging work.

Challenges and Teacher Supports
As the FOSS modules and courses were implemented, we hit some challenges along the way. The most immediate challenge was how to get those 10 brand-new teachers and other new-to-science teachers comfortable with managing active investigations almost daily. We tackled this issue with one-on-one coaching, in some cases for the duration of the report period. Coaching takes the form of co-planning, co-teaching, doing model lessons, evaluating student work, and providing in-the-moment feedback that is designed to move teacher practice quickly and ensure a lasting change of teacher habit. This is by far the most successful lever we use to maximize student achievement.

Besides building comfort levels, another initial hurdle for all teachers was helping them navigate a two- or three-day lesson. Teachers were used to hitting a specific target daily; they were struggling with the pacing of FOSS. To support teachers, we design central unit plans that include a calendar showing which steps in the investigation to complete daily, along with aligned objectives and exit slips to make the lesson goals more concrete.

Next, getting all teachers capable of navigating the depth of a FOSS lesson was a challenge. With limited time available and limited content knowledge, teachers needed to learn how to make decisions about which questions to ask during the lesson that would ultimately provide enough time and lead to understanding so students could answer the focus question.

Continued on page 8
To make consistently meaningful decisions, teachers wrote focus question exemplars. During bi-weekly planning meetings, teachers collaborated to determine the exemplar response. They read the Investigations Guide to learn the basic activity, read the “What to Look For” section, defined the new vocabulary listed, and then jotted down the evidence students collect throughout the investigation. This draft was then written into an extensive focus question response that the group revised until they were satisfied.

Teachers and PD facilitators worked together to create a collaborative classroom environment. They have been trained for so long to answer in multiple choice responses that overcoming student trepidation over exposing themselves through writing in science was a very real issue. We also had to do some significant work to overcome teacher mindset about what students were capable of producing. Our answer was to award students points for perseverance on their focus question responses. If students showed revisions of the focus question, they received some credit whether the answer was correct or not. Providing the space to have students revise their responses (and reward them for doing so) opened doors for many teachers.

Other teachers benefitted from participating in co-teaching where student revision time was modeled. It turns out that building a growth mindset is incredibly powerful for motivating students.

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Our most recent big challenge was getting students to actually write. They have been trained for so long to answer in multiple choice responses that overcoming student trepidation over exposing themselves through writing in science was a very real issue. We also had to do some significant work to overcome teacher mindset about what students were capable of producing. Our answer was to award students points for perseverance on their focus question responses. If students showed revisions of the focus question, they received some credit whether the answer was correct or not. Providing the space to have students revise their responses (and reward them for doing so) opened doors for many teachers.

Using the exemplar focus question response as a guide, teachers narrowed down the most important questions from each step of Guiding the Investigation that will get students to this high bar. Through these co-planning sessions, we’ve overcome the challenge of navigating FOSS, and students now have the ability to work together to create a collaborative classroom environment.

### Outcomes

In our first report period, 95% of teachers successfully implemented the FOSS curriculum in their classroom. Twenty-two out of 23 teachers have students actively investigate, write in student notebooks, and participate in each lesson as groups. By the end of the first 30 days, students across campuses averaged a 5.6 of 8 for the group work rubric and a 6.6 of 10 on the notebook rubric. Our goals were 6 and 8 respectively.

The teachers and students worked hard and as a result, there was more engagement in their science lessons. An administrator told me, “I love this new science program and I hate it at the same time. I LOVE how engaged kids are in science and how much they’re learning, but I can’t get them to stop talking about science in their other classes!”

### Using a Modified TEAM$^2$ Tracker Adapted from CPM (College Preparatory Mathematics), teachers gave specific feedback to each group about their ability to work together to create a collaborative classroom environment.

- **T** Teamwork was not present. The work was carried by 1 or 2 team members.
- **E** No explanations or reasons were overheard throughout the activity.
- **A** Little to no academic discussion was observed. The learning team was off-task a significant portion of the time.

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<tr>
<td><strong>T</strong></td>
<td>Teamwork was not present. The work was carried by 1 or 2 team members.</td>
<td>At least one member of the learning team was disengaged numerous times.</td>
<td>The entire learning team worked together to answer questions most of the time.</td>
<td>The entire learning team worked together to answer questions 100% of the time.</td>
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<tr>
<td><strong>E</strong></td>
<td>No explanations or reasons were overheard throughout the activity.</td>
<td>Explanations and reasons were overheard infrequently amongst team members.</td>
<td>Most members were overheard explaining or giving reasons throughout the activity.</td>
<td>Every member was overheard explaining or giving reasons throughout the activity.</td>
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<td><strong>A</strong></td>
<td>Little to no academic discussion was observed. The learning team was off-task a significant portion of the time.</td>
<td>Academic discussion was limited in the learning team. Off-task speak was observed more than once.</td>
<td>Academic discussion and questions were overheard throughout the activity. Some off-task speak.</td>
<td>Academic discussion and questions were overheard throughout the activity. Conversations were about science.</td>
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We collect a significant amount of data on student performance to measure progress. At the end of every report period, a centralized benchmark is used to identify trends across the network and accurately pinpoint places for support. One trend we noticed was students were finally performing better on open response questions. While students showed improvement, they still underperformed in proficiency, which at Mastery is scoring a 76% or better on the benchmark exam. We also noticed students who more frequently completed the focus...
question responses scored higher on the benchmark than their peers.

With all of this data in mind, our goal for report period 2 is to improve focus question responses. To aid this goal, we are requiring student explanations in the group work rubric. The more students explain their thinking to their peers, the more clear their ideas become, and so should their focus question responses. To aid teachers and students in organizing the focus question responses, we will have professional development centered on using notebook next step strategies such as the line of learning within a graphic organizer. This organizer will serve as the rough draft of the focus question response from which students will write the paragraph final version of the focus question in their notebooks. Finally, coaching will be provided to teachers needing the most assistance to move students toward this high bar.

**FOSS’s Impact in Our Classrooms**

While students are achieving at a greater level than before, the most notable impact has been in investment of Mastery’s leadership, teachers, and students. Teacher mindset has changed from one of fear and discomfort to one of collaboration and genuine enthusiasm for teaching science. Administrators are asking over and over how much more FOSS we plan to roll out next year as they’ve seen student success and investment in science soar. And students are proud of their work—they feel a sense of ownership over their notebooks and they’re excited to share. Yes, even those hard to reach middle schoolers are excited! I recently witnessed a class of seventh-graders having the most animated discussions over foliation!

Perhaps my favorite success story comes from a third-grade classroom. We received a module on consignment from Delta Education. Last year, one student’s struggle stood out to me in particular. I was informed by his administration that he was struggling to find his place in every class he had. His investment was at an all-time low and his mother had to come to the school nearly every day for a meeting. Within a three-month time period, this student went from writing one sentence focus question responses to having more than a page of detailed and correct answers! I saved his notebook to show others, because it is a testament to the power of such a fantastic program. You can literally flip from page to page and see his growth through the notebook. At the end of the term, he scored a 95% on his last benchmark, which uses mostly questions from the FOSS posttest. I’m thrilled to be working with a rigorous and comprehensive program that has the ability to transform our students into the budding scientists we know they can all be.
More and more we hear requests for FOSS materials in other languages. These inquiries follow a trend that shows a substantial rise in the number of dual language immersion schools across the country (currently estimated at over 1,000 and growing each year). Also called “two-way” language immersion (TWI), the goal of this type of bilingual instruction is for native English speakers to learn a second language (referred to as the “target” language), while their classmates who speak the target language learn English. In most TWI schools, Spanish is the target language, however, Mandarin is increasing in popularity. Last fall, as part of an effort to improve relations with China, President Obama announced the launch of “1 Million Strong,” an initiative aimed at having one million Mandarin language learners in U.S. schools by the year 2020.

Is it possible? We asked the Director of Mandarin Curriculum and Instruction for Yu Ming, a TWI Charter School in Oakland, California. The answer is yes. Enrollment has increased at Yu Ming every year since they opened in 2011. This heightened interest can be seen in the majority of states in the United States, where parents anxiously have their children on waiting lists to enter TWI programs. In addition to Spanish and Mandarin, schools are offering other languages such as Arabic, French, Haitian-Creole, Hebrew, Korean, Polish, Russian, Portuguese, Vietnamese, Hindi, as well as indigenous languages. Many states are currently expanding their programs with much success. For example, Utah has surpassed its goal and now has 9% of its public elementary school students enrolled in TWI programs. In Portland, Oregon, nearly one in five kindergartners is learning in two languages.

Why are states rushing to open and expand TWI schools? The research shows that TWI is the most effective model for learning another language and contributes to long-term academic success for both English language learners and the target language learners. In addition, many states and districts feel TWI supports their goal of preparing their students to succeed in a global economy. The founders of Yu Ming charter school in Oakland believe that TWI supports the development of critical thinking and problem solving, creativity, and communication. To that end, their students needed a challenging and engaging curriculum to provide the context for this type of active learning. Last year, Yu Ming worked with FOSS and Delta Education to translate some of the Next Generation Edition student materials into Chinese. A Yu Ming administrator explains, “FOSS fits in well with Yu Ming’s vision of nurturing our students’ intellectual curiosity, compassion, and a sense of responsibility for the community and the environment. Although sometimes the translation is hard for students to understand, the active investigations of FOSS help students to make connections across the language divide.”

Teachers at Yu Ming expressed that FOSS makes it easier to teach science in Mandarin. The same features that help English-speaking students learn science (engaging hands-on investigations, science notebooks, and collaborative group work) also allow them to successfully teach science in Mandarin. Their students readily engage in the investigations and are able to conduct rich science talk in Mandarin. Now they want more. One of the teachers, Xinyi Xu, is hopeful to have additional online resources in the future, such as multimedia, streaming videos, and FOSSmap, to help deepen students’ understanding and help them explain the patterns they discover in Chinese.

A teacher reads to the class using the Pebbles, Sand, and Silt Module Science Resources Book, with added translations to Chinese.
At Adelante, a Spanish TWI charter school in Santa Barbara, teachers have been using FOSS since its inception in 2010. Paula Sevilla, a fifth-grade teacher explains why,

One of the beautiful things about dual immersion is that it makes us all language learners. One of the beautiful things about FOSS, is that it provides a series of intentionally designed experiential investigations that grow students’ knowledge of scientific content while, simultaneously, providing a context for the language required to speak, read, and write about said content. Every investigation requires that students get their hands dirty! They investigate scientific tools and concepts that are new to them and are asked to speak to their colleagues about that very information. Since we do our science in Spanish, I get to see my Spanish language learners get excited about the science and become less self-conscious. They get distracted from their fear of speaking their second language and begin wrestling with and seeking to utilize the vocabulary and content they are investigating. Language is never a solitary venture; it is always practiced when there is something of worth about which we would like to communicate. FOSS provides interesting and challenging scientific inquiries that my students want to talk about, read and write about.

Sevilla adds that the biggest challenge for her and some of her colleagues has always been their lack of science content knowledge. She has had to do a lot of learning on her own and explains,

I sought out a friend who teaches chemistry and continually asked for drawings to represent what we were learning, such that I could present things in a similar fashion to my students. I think the best advice I can give is to do the same, i.e., admit you need some help, find it and use a ton of images to support all of your students, because, in science, all of our students are language learners!

Currently, FOSS offers materials in Spanish to support TWI. All FOSS elementary modules include digital access to Spanish student notebook sheets, teacher masters, assessments, and eSRBs. With FOSS Next Generation, the print Science Resources book is also available in Spanish. The FOSS Texas Edition includes all student material plus all the teacher materials, including the Investigations Guide in Spanish.

If you are interested in joining a network of dual language educators using FOSS, please contact Diana Vélez at dvelez@berkeley.edu.
A Brief History of Science Education Reform

In the mid 1990s, NSF was mounting a series of major science education reform efforts—the State Systemic Reform program, the Urban Systemic Reform program, the Rural Systemic Reform program, and the Local Systemic Reform program. The architects of these programs were sincere; the goals were laudable, and the enthusiasm on the ground was palpable. But ultimately, the envisioned reforms were not realized.

The architects of the programs got one thing right; for reform to be broad-based and durable, the reform had to be systemic. But they missed the mark on two counts; they identified the wrong systems as the targets for reform, and they used the wrong action process. The systems were far too large and complex to reform in the short time frame allowed and with the modest funding provided. The visions and expectations were just too grand to succeed. And reform is not the right description of the desired change. The problem with reform was that project organizers and managers attempted to do just that—simply reshape the science education enterprise by reassembling the same institutional parts in slightly different ways. Same old pieces reconfigured in a different ineffective way. What the program visionaries should have called for was revolution: that the participating projects invent their systems’ whole approach to teaching science. Revolution suggests bold, creative innovation, probably involving some measured risk-taking.

An Audacious Attempt at Remedy

In the late 1980s, The Full Option Science System (FOSS) concept was cobbled together from a small special education program and a heroic dream. The science education climate in the United States was dismal. Undaunted, we accepted the challenge of breathing life into the moribund science education enterprise. Two National Science Foundation grants and six years later in 1995, the first edition of K–6 FOSS was in the box (the black-and-white cabinets), and we found ourselves confronting a dimension of our work that we had not really thought through. To realize the potential for student science learning we had to engage the support of the classroom teacher. Teachers needed to learn how to use the FOSS modules effectively.

Fast forward two decades to 2016. With the benefit of 20/20 hindsight—and the experience of having played in all iterations of the systemic reforms of the late 20th century—it is now time to reassert the call for a new systemic revolution (revolution, not reform). What follows are some thoughts by Larry concerning the 21st century call to reinvent school science.

1. The unit of systemic reform should be the school. Science education reform can and should be a site-based activity.
2. The reform should be enacted using a staff development model (not a traditional professional development model, which advances the professional learning of individuals). The entire staff must engage the revolution together.
3. The staff learning should be classroom curriculum centric (FOSS certainly the preferred treatment). Teachers learn to teach science using the science curriculum that students will experience.
4. Revolution leaders should design and communicate clearly defined goals. I don’t have room in this piece to elaborate on the goals of staff development. However, one goal should be to create a school culture with clear unflinching focus on improving student learning, which is one element of an overall school culture of constant improvement.

The goal of such an enterprise is first-rate science teaching/learning. As we stand here preparing to explore the next generation of science education, it is natural to feel a bit of apprehension. The new standards present an invitation to a revolution. Yes, it is complex, but not difficult.

Exposing the Educative Curriculum

The terrain has been carefully mapped and the signage along the path is clear and ample. The map is the FOSS curriculum and the signage is the Investigations Guide. An educative curriculum is one that is written in two voices, one voice is the traditional voice providing a carefully crafted, coherent framework for guiding student learning; the second voice speaks directly to the teacher with information concerning dimensions of the subject matter content, pertinent bits of educational research, and opportunities to integrate other dimensions of learning into the science instruction. I’d like to introduce you to some of the educative elements in the FOSS Investigations Guide.

Observations . . . by Larry Seeing Voices

By Larry Malone, FOSS Co-director

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The primary voice in the *Investigations Guide* is the suggested learning activities—in short, the lesson plan. That is the traditional voice of a curriculum guide. It describes the sequence of learning events that will guide students carefully through learning experiences that lead to effective acquisition of intended knowledge. It is straightforward, but not always easy to engineer in the classroom. This is the pass-through message in the curriculum guide—the voice of the curriculum heard by the student learners with the teacher as intermediary.

There is nuance to creating the environment that promotes efficient, effective engagement with focused learning. The methods used by the teacher to carry the learning forward are pedagogical moves—the how-to-teach dimension of classroom instruction. And pedagogy is further subdivided into general pedagogical moves (classroom organization and management, discourse norms, etc.) and those pedagogical moves that are specific to the content being taught. The second voice in the *Investigations Guide* is related to the pedagogical moves, and it is heard by the teacher only.

It has been a long-standing position of the FOSS developers/designers that it is not our role to tell teachers how to teach. But with more than three decades of experience and the benefits of academic research, we have come to recognize that there is a body of specialized pedagogical content knowledge (PCK) that is advisable to share with teachers. The specialized PCK and the specific science content knowledge are both critically important for delivering a first rate teaching/learning experience. These two categories of information are communicated to the teacher in the FOSS *Investigations Guide* in a number of carefully crafted ways, which collectively constitute the educative voice in the program.

The educative voice is like a personal assistant speaking privately in your ear while you are planning to teach or actively engaged in teaching. The educative information is not part of the lesson per se, but ancillary knowledge for delivering the lesson effectively. The educative lagniappes are presented in a number of predictable locations.

**Front Matter: Information Preceding the Lesson Plans**

*a.* The first document in the *Investigations Guide* is the module Overview chapter. This chapter introduces the broad strokes of what the FOSS Program is, how it is organized, and how those elements work together to provide a coherent instructional resource for engaging students in a meaningful and rewarding adventure into the wonders of the natural world.

*b.* The second document in the *Investigations Guide* is the Framework and NGSS Chapter. This chapter communicates the overall vision of a comprehensive elementary science education in the FOSS Conceptual Framework section. This chapter also includes a Background section—a condensed discussion of the science content covered in the module. The background discussion ranges across the subject matter terrain to be taught, but delves into the science content to a deeper level than the level to which you will engage students. Another important message embedded in this chapter is the critical idea that major science concepts, e.g., the atomic theory of matter, are complex, and instruction concerning them should be delivered incrementally; that is, there is a cognitively/instructurally appropriate progression concerning how these concepts should be developed thoughtfully and carefully over multiple years. The learning at each grade contributes ultimately to a fully formed concept by the time students have advanced through their elementary and middle school careers.

Here, too, is our exposé of the connections to the three dimensions of the Next Generation Science Standards (NGSS)—disciplinary core ideas, science and engineering practices, and crosscutting concepts. Because the NGSS are not taught in the same manner as traditional standards, teachers need assistance learning how to meet the standards without engaging in specific, explicit instruction. It’s tricky business, requiring a considerable amount of educative support along the way.

*Continued on page 14*
Investigation Chapters

The investigation chapters (usually four in number) are the lesson vehicles. Each contains numerous educative elements. There is a section headed “Teaching Children about . . .” that provides discussions about possible stumbling places where students may exhibit well-documented misconceptions, and additional discussions about the opportunities for engaging students in the science and engineering practices and opportunities to expose examples of the crosscutting concepts. Also, the first few pages of the investigation chapter have a discussion of the science content for the teacher, subdivided into sections that discuss the specific content associated with each focus question in that investigation. Each investigation is subdivided into several parts. Each part is framed by a focus question which serves two main functions. First and foremost, the focus question defines what students are expected to learn as a result of instruction in that part. It is communicated as an intellectual challenge to students up front, and stands to alert the teacher of the objective of the lesson. In the latter regard it is an educative element. The focus question is a gentle voice reminding the teacher to attend assiduously so that students will be able to answer the question at the completion of instruction in the part.

### Investigation — Patterns of Motion

<table>
<thead>
<tr>
<th>Investigation Summary</th>
<th>Time</th>
<th>Focus Question/Practices</th>
<th>Content Related to DCI</th>
<th>Writing/Reading</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel-and-Axis Systems</td>
<td>Activity 1</td>
<td>How can we change the motion of wheels rolling down ramps?</td>
<td>• The patterns of an object’s motion.</td>
<td>Science Notebook Entry</td>
<td>Embedded Assessment</td>
</tr>
<tr>
<td></td>
<td>1 Session</td>
<td>Planning and carrying out investigations</td>
<td>Invariant situations can be observed and measured.</td>
<td></td>
<td>Science notebook entry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• A wheel-and-axle system with two sizes of wheels describes a curved path when rolled down a slope.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The system curves toward the smaller wheel.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predicting Motion of New Systems</td>
<td>Activity 1</td>
<td>What rules help predict where a rolling cup will end up?</td>
<td>• A wheel-and-axle system with two sizes of wheels describes a curved path when rolled down a slope.</td>
<td>Science Notebook Entry</td>
<td>Embedded Assessment</td>
</tr>
<tr>
<td>Students roll paper cups down ramps and watch the different behaviors of rolling systems with two different sized wheels. They observe the way cups roll and use the predictable rolling pattern to invent challenges. They put cups together to make ramps of different heights and weights to arrive at an answer.</td>
<td>1 Session</td>
<td>Planning and carrying out investigations</td>
<td>The system curves toward the smaller wheel.</td>
<td>Response sheet</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• When a system exhibits a regular pattern, its motion can be predicted.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twisty Birds</td>
<td>Activity 1</td>
<td>Student-created question, e.g., What happens to the motion of a twisty bird when the design changes?</td>
<td>• A twisty bird is a simple wrapped system that spins when it intersects with . . .</td>
<td>Science Notebook Entry</td>
<td>Embedded Assessment</td>
</tr>
<tr>
<td>Students make twisty birds using strings and paper</td>
<td>1-2 Sessions</td>
<td>Planning and carrying out investigations</td>
<td>• Twisty performances are affected by variables, including ring size, shape, and color.</td>
<td>Tangled investigations</td>
<td>Performance assessment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analyzing and interpreting data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Obtaining, evaluating, and communicating information</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taps</td>
<td>Activity 1</td>
<td>What is the best design for a tap?</td>
<td>• Taps exhibit rotational motion (spinning) when torque is applied to the side shelf.</td>
<td>Science Notebook Entry</td>
<td>Benchmark Assessment</td>
</tr>
<tr>
<td>Students make taps from plastic disks and shafts, and spin them by applying a torque force to the shelf. Whirling the arrangement at parts that protrude from the taps allows them to look at different designs as they spin. Finally, they look at the path a drawing tap reveals as it spins.</td>
<td>1 Session</td>
<td>Planning and carrying out investigations</td>
<td>• Tap performance is affected by variables including speed, disk mass, and distance.</td>
<td>Answer the focus question</td>
<td>Investigation 2’s Check</td>
</tr>
<tr>
<td></td>
<td>Assessment 2</td>
<td></td>
<td></td>
<td>Science Resource Book</td>
<td></td>
</tr>
</tbody>
</table>

**At a Glance**

<table>
<thead>
<tr>
<th>Patterns of Motion Module — FOSS Next Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>110 Full Option Science System</td>
</tr>
</tbody>
</table>

The **At a Glance** chart in each investigation shows how the parts and sessions are integrated into a coherent instructional piece. The example above displays the plan for Investigation 2, **Patterns of Motion**, in the third-grade **Motion and Matter Module**. Students engage with specific practices as they investigate phenomena to answer the focus question for each part.
The wide yellow sidebar (margin) in the investigation chapter is where we offer a variety of helpful notes to teachers at the precise location in the lesson where they will be most useful. Sidebar notes indicate connections to the science and engineering practices and crosscutting concepts, which along with the disciplinary core ideas (science content) constitute the three dimensions of the next generation approach to science teaching and learning. Additional sidebar-note educative whispers may suggest how and when to engage students in science talk incorporating academic vocabulary or a particularly appropriate ELA strategy, or may be a reminder that the actions happening here relate to something students did a few days ago, or may indicate that this action is a setup for something that is coming up in a day or two. These alerts help the teacher stay attuned to the larger scope of the current experience.

**Other Dimensions of the FOSS Experience**

The FOSS experience embraces multiple dimensions of the learning experience: discourse, outdoor extension, science notebooking, reading, and assessment. In a fully actualized FOSS classroom, all of these elements are fully integrated into one seamless learning experience. Learning all the moves needed to conduct this symphony, requires support, and we have attempted to design in those supports as intuitively as possible with a quiet educative voice speaking just below the public address level.

It would be nearly impossible for me to point out every instance of educative support designed into the FOSS program, but it is definitely a worthy enterprise. I suggest that the most valuable way to discover all of the educative murmurs in FOSS is to adopt the program and mount an implementation that includes a professional learning community approach that permits all of the grade-level teachers to teach the same module at the same time and to have bimonthly meetings to share and compare classroom experiences. One of the Professional Learning Community (PLC) activities can be a type of Where’s Waldo? activity—finding, comparing, and evaluating the host of educative inclusions branching off from the curriculum mainstream.
**FOSS Goes to Summer School**

*By Joanna Totino, FOSS Elementary Specialist & Director of the Bay Area Science Project*

We’ve been hearing more and more about FOSS being used in summer schools around the country. In this issue we highlight two programs in California taking different approaches to bringing active learning to summer school students.

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**Summer Science Camp: Live Oak School District**

Live Oak School District is a small district in Santa Cruz County. The county spans from the Pacific Coast to the mountains in Central California just south of San Francisco. Live Oak held Summer School Safari 2014 and The Summer Adventure Continues 2015, targeting at-risk students in English Language Arts (ELA) and math. Only students entering grades 4–6 participated in a FOSS Science Camp.

**The District**
The Live Oak School District has approximately 2,100 students in three elementary schools, one middle school, one K–8 independent charter school, one charter high school, and one alternative school. The district embraces the diverse student population, which includes Latino 50%, Caucasian 31%, and other ethnicities 19%. Approximately 33% of students are English learners, and approximately 84% of the English learners speak Spanish. Sixty percent of the students participate in free and reduced lunch.

**The Model**
Live Oak’s model was to create a program that would benefit students and get their upper elementary grade teachers familiar with the FOSS curriculum before teaching it during the school year. They felt that the summer would be a great opportunity for teachers to experience the structure and daily use of FOSS.

Melanie Sluggett, Program Director of Child Development & After-School Programs, and summer school principal in 2014 and 2015, described that they wanted to see how the students responded to the curriculum and provide in-depth FOSS teacher training at the same time. Summer school funding was limited and primary students needed literacy intervention; therefore, they chose only the upper grades to start using FOSS.

Live Oak had a champion FOSS lead teacher, John Hayes. He presented the idea to the district and supported the effort throughout. He provided five hours of professional development training at the start of summer school and was the lead summer school teacher. “Mr. Hayes’s open-door policy beautifully supported the teachers with any questions they had,” said program director Melanie Sluggett. Hayes also met with teachers at the end of the summer school day to discuss use of notebooks, ELA/ELD integration, oral discourse strategies, and FOSS curriculum.

**The Program**
The Live Oak program was held for four hours per day for four-weeks, including recess and lunch. Students attended FOSS Summer Science Camp from 8:30–12:30 p.m. for 20 days. The students used the computer lab 30 minutes a day to read/listen to the eSRBs and make final presentations.

The FOSS summer school teachers decided which module they wanted to teach. In 2014, the first year, there were three classrooms, one class per grade, with approximately 25 students per class. The summer of 2015, they added a grade 3–4 combination class, so there were 4 classrooms with 100 students. Two teacher’s aides were hired to assist in the four classrooms working collaboratively with the teachers.

**FOSS Module Use**

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>2014 FOSS Summer Modules</th>
<th>2015 FOSS Summer Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–4</td>
<td>N/A</td>
<td>Pebbles, Sand, and Silt, Next Generation</td>
</tr>
<tr>
<td>6</td>
<td>Weather on Earth, Third Edition</td>
<td>Weather on Earth, Third Edition</td>
</tr>
</tbody>
</table>

FOSS MODULES USED IN LIVE OAK SCHOOL DISTRICT FOR THE SUMMERS OF 2014 AND 2015

**Teacher Results**
In both 2014 and 2015, teachers were recruited from the district to teach FOSS summer camp. In 2015, the district offered stipends for any district teacher to come and observe FOSS in action during summer school. Six teachers attended for two days each and gave positive feedback to the district. As a result, those teachers are using FOSS in their classrooms presently.

**Students Results**
Teachers felt that it enhanced the learning for those students who experienced a
FOSS module during the summer and again during the school year. Actually, teachers saw students take on the role of leaders when doing the same FOSS module during the year. For example, students who usually struggle with language began using the science vocabulary consistently and appropriately much earlier in the learning process.

Qualitative observations of student notebooks, participation, and presentations revealed an increase in student understanding. Sluggett recalled, “Students did presentations at the end of each week; after four weeks I saw dramatic improvement in science vocabulary, concept knowledge, as well as presentation skills and group cooperation in all FOSS classrooms; it was remarkable!”

John Hayes, lead teacher, added “the summer program was symbiotic. We wanted a high engagement curriculum and a PD opportunity for teachers. I think we achieved both. It gave teachers the opportunity to break in FOSS modules before teaching that same FOSS curriculum in the school year. The students at summer school are some of our neediest in terms of academic progress, and they performed admirably. Reasons for this are short day, small class size, engaging curriculum, and enthusiastic teachers.”

Future
FOSS is being implemented at all school sites, grades 4–6, during the 2015–16 school year. The intention is to implement FOSS in grades K–3 in the coming years. There will be a new summer school principal for 2016, but Sluggett believes FOSS will again be implemented this summer. The Live Oak team established a creative and collaborative approach to enhance learning for both teachers and students at their FOSS summer camp.

References
http://www.ed-data.org

Extended Learning Summer School Program: West Contra Costa Unified School District

West Contra Costa Unified School District (WCCUSD) historically has many students who have been asked to attend an intervention summer school. In 2014, WCCUSD administration began to look for a program that would provide the opportunity for students to engage actively in their own learning. “We wanted to create a genuinely engaging and confidence building summer program. We decided that a successful hands-on, inquiry-based science program would support our students in the critical area of science; our intent was to build a solid foundation in the content area as well as motivate students to want to learn more about the world around them as they moved into next academic year,” said Lyn Potter, Education Director. Potter contacted the Lawrence Hall of Science and contracted for the consulting, design, and coordination of the FOSS Science Summer School.

The District
WCCUSD serves around 30,000 students K–12 from the cities of Kensington, El Cerrito, Richmond, San Pablo, Hercules, and Pinole. It consists of 36 elementary, 7 middle, and 6 high schools and 4 alternative schools. According to the California Department of Education, approximately 70% of the students receive free and reduced lunch; approximately 33% of the students are designated as English language learners.

The Model
The Extended Learning Summer School Program, an existing WCCUSD program, began using FOSS as a part of the program in 2014. The program runs for four weeks from 8:30–2:30, with one 20-minute recess. Approximately 1,500 grade 1–8 students attended in both years. The students have three 90-minute blocks of time. Students rotate through a 90-minute period of English language arts (ELA), math, and science each day throughout the four weeks. Approximately 1,500 students attend summer school, with approximately 30 students per regular education classroom.

FOSS CA professional development staff worked closely developing and coordinating with education services to develop a comprehensive FOSS summer school program. Approximately 60 WCCUSD teachers were

Continued on page 18
hired to teach science. Each teacher received FOSS professional training from FOSS staff at the Lawrence Hall of Science prior to the start of summer school. In 2014, teachers received 22 hours; in 2015, teachers received 16 hours of professional learning. The training was designed using strong literacy integration, supported with scaffolding, oral discourse, writing, and vocabulary development. This comprised of approximately 2.5 days of FOSS professional development introducing the module, along with material and classroom preparation. Midway through summer school, the FOSS coordinator met with all the FOSS science teachers to reflect and discuss challenges and successes.

The Program
At the request of the district, the FOSS coordinator created a pacing guide and detailed schedule for each grade, to help teachers try to move through the module in the four weeks. Additionally, the FOSS coordinator created a notebook sequence using notebook and assessment masters and included blank pages when extra writing was necessary. The district pre-copied the notebook for each student, which relieved the teachers from doing this task.

The modules that were purchased and used were FOSS Third Edition and FOSS Next Generation Edition. An even- and odd-year system was created so returning students did not repeat modules.

Improved their scores. The pre-assessment data indicate a need for additional emphasis on teaching science in the elementary grades.

Future
For the summers of 2014 and 2015, WCCUSD students received an effective science summer school experience, and summer school teachers were provided with a valuable professional development opportunity. WCCUSD is planning to continue with this model in 2016. The district will purchase one more middle school title for next year.

Teacher Results
Approximately 50% (32) of the FOSS science teachers taught summer school in both 2014 and 2015. Summer school staff reported that students and teachers loved the FOSS science lessons and students looked forward to their science block. When district educational services staff did classroom visits, they observed high student engagement in their science lessons. The FOSS training for the summer school teachers impacted the teachers practice during the regular school year. Teachers learned a lot about integrating science with their Common Core ELA standards. Teachers reported using science notebooks back at their sites with their students. Many teachers wanted to teach FOSS during the school year.

Student Results
All students took a FOSS survey (pretest) and posttest. For primary grades where no test existed, one was created by the FOSS coordinator. Students at all grade levels improved their scores. The pre-assessment data indicate a need for additional emphasis on teaching science in the elementary grades.

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References
http://dq.cde.ca.gov/dataquest/

Total K–12 Enrollment by Ethnicity for 2014–15

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>African-American</td>
<td>18.9%</td>
</tr>
<tr>
<td>American Indian</td>
<td>0.4%</td>
</tr>
<tr>
<td>Asian</td>
<td>11.4%</td>
</tr>
<tr>
<td>Filipino</td>
<td>6.0%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>51.6%</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>0.9%</td>
</tr>
<tr>
<td>White</td>
<td>10.8%</td>
</tr>
</tbody>
</table>

An even- and odd-year system was created so returning students did not repeat modules.

Register now!
This summer we’re very pleased to be holding five institutes at the Lawrence Hall of Science in Berkeley, California! Designed for leadership teams in districts transitioning to the NGSS, there are institutes for new FOSS users and experienced FOSS users from elementary through middle school. See page 19 for more details.

www.fossweb.com/pd-event-calendar
FOSS Institutes: Fall 2016

Delta Education will host two half-day FOSS Institutes before each of the three 2016 NSTA area conferences in Minneapolis, MN (10/26/16); Portland, OR (11/9/16); and Columbus, OH (11/30/16). These Institutes will be for educators from districts that have implemented FOSS or are planning to implement FOSS. The Institutes will focus on FOSS Next Generation Elementary and Middle School and are designed for 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 contact:
Jenn Reid Strong at Delta Education
800.338.5270 x3667
jenn.reid@schoolspecialty.com

NSTA NATIONAL CONFERENCE
Nashville, March 31–April 1, 2016

K—8 Workshop Schedule

Thursday, March 31
8:00–9:30  Ten Minutes to Improving Science Achievement
10:00–11:30  What Does Argumentation Look Like in an Elementary Classroom?
12:00–1:30  Floods, Heat Waves, and Hurricanes: Analyzing Evidence for a Changing Climate Using FOSS
2:00–3:30  Get Them Started Early and Make it Relevant—K–2 Science and Engineering Experiences
4:00–5:30  What Does Conceptual Modeling Look Like in Grades 5–7 Classrooms?

Friday, April 1
8:00–9:30  What Does Argumentation Look Like in an Elementary Classroom?
10:00–11:30  What to Look for in Physical Science Learning Progressions—Experience FOSS K–5
12:00–1:30  Modeling Energy Flow in Ecosystems: Developing Models in Middle School Life Science
2:00–3:30  Designing with FOSS: Engineering in Elementary Science
4:00–5:30  Archaea and the Three Domains: Classification of Life for Middle School

Saturday, April 2
8:00–11:00  Models: A Key to Making Thinking Visible (short course)

CABE CONFERENCE 2016
San Francisco, March 23–26, 2016

Thursday, March 24
3:15–4:30  Los Conceptos Transversales de las Ciencias para todos los Estudiantes (“Crosscutting Concepts for All Students” in Spanish)

Saturday, March 26
9:00–12:00  Engineering Understanding: Applying Science Concepts and Building Academic Language

The Lawrence Hall of Science Institutes
The Lawrence Hall of Science, Berkeley, CA

June 28–30, 2016
FOSS K–5 Next Generation Institute for Experienced Users

July 25–27, 2016
FOSS K–5 Next Generation Institute for New Users

July 7–8, 2016
Human Systems Interactions, Next Generation Edition: New Short Course for Middle School

July 11–14, 2016
Chemical Interactions, Second Edition: A Focus on Modeling and Engineering

July 28–29, 2016
FOSS K-5 CA NGSS Institute—Designed for California Educators
Introducing FOSS Next Generation: Designed to support the NGSS at every grade level, K–8!

Here's some of what is included in this edition:

- Investigations support the disciplinary core ideas, crosscutting concepts, and science and engineering practices of the NGSS.
- New interactive tablet-ready eInvestigations Guide for teachers puts program guidance at your fingertips.
- New eBooks make the FOSS Science Resources print book accessible from your laptop or mobile device.
- Expanded technology resources include virtual investigations and interactive whiteboard activities.
- Each module or course includes multiple consecutive class uses of consumable materials.

Read about FOSS Next Generation on page 12 of this issue and visit deltaeducation.com/FOSSNG to learn more!