FOSS

Developed at:

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

The best science lessons teach more than science.

“Students absolutely love the hands-on experimentation. It makes science come alive for them. English Language Learners can easily learn the academic language of the discipline because they experience the concepts in the real world and write about their observations. Thanks to FOSS, my students love science and actually beg for more.”

Peggy S.
Educator/Gifted & Talented
Education Coordinator California

In FOSS, young scientists put their ELA skills to work.

FOSS® is intentionally designed to promote connections between science and language arts and to help build critical literacy skills. Students who use FOSS view the world like scientists – they investigate, learn by processing their experiences, then use reading and language skills to think about and share what they’ve learned. As a result FOSS® develops higher-order thinking and problem-solving abilities that, in turn, support academic literacy in all subjects and help teachers realize the promise of cross-curricular teaching.

Active investigations

FOSS gives students regular, structured opportunities to talk in pairs and small groups. The students learn to contribute accurate, relevant facts to their sense-making discussions and to argue from the evidence.

Science notebooks

Students have a place to keep an organized record of observations, questions, and conceptual understanding, building their ELA skills in the course of their work as scientists.

FOSS Science Resources readings

Readings are designed to complement and enhance active investigations. Students pose questions, support their ideas with evidence, acquire information from text and other sources, and interpret illustrations to build understanding.

Formative assessments

Students can formally practice the same communication skills they use informally in their notebooks. As they develop and use models and defend their conclusions, they exercise the language functions needed for higher-order thinking.

FOSS students learn to talk, read, and write like scientists.

FOSS students develop language the same way they learn science: by doing. FOSS naturally integrates language into the course of their scientific explorations, making it an integral part of their hands-on activities.

Speaking and listening

FOSS immerses students in a culture of speaking and listening as they process and organize their own learning, apply their knowledge, and solve problems in collaborative groups.

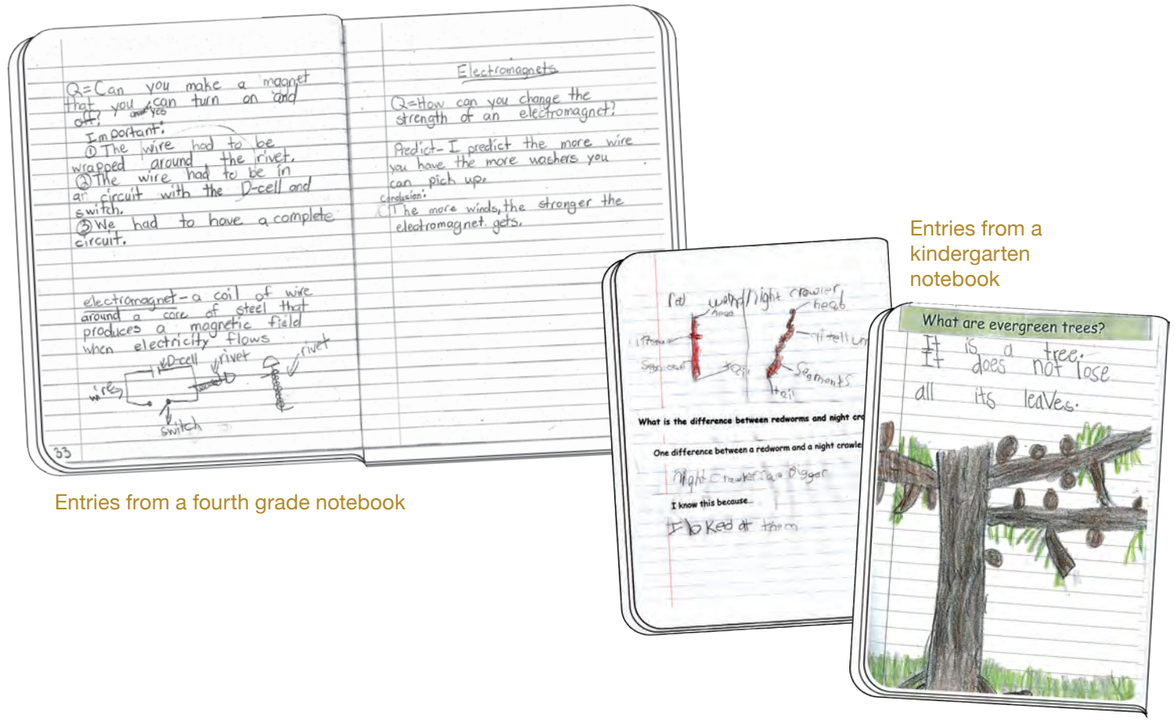
Sense-making discussions

Sense-making discussions help students review and confirm information from active investigations, and organize it to find connections and relationships in the data to construct conceptual knowledge. This discussion also helps students organize and communicate their thinking as they collaborate with their peers, helping them develop conceptual models about phenomena.

FOSS classroom posters support students during sense-making discussions. Download posters provided on FOSSweb or create your own.

Writing in science notebooks

Scientists' notebooks are detailed records of their engagement with natural phenomena. FOSS students work and think as scientists do, developing their own detailed science notebooks throughout the school year. Science notebooks help students organize observations, process data, communicate their thinking, and maintain a record of their learning. This process not only develops writing skills, but also builds science competency through the communication of evidence-based ideas.



Entries from a fourth grade notebook

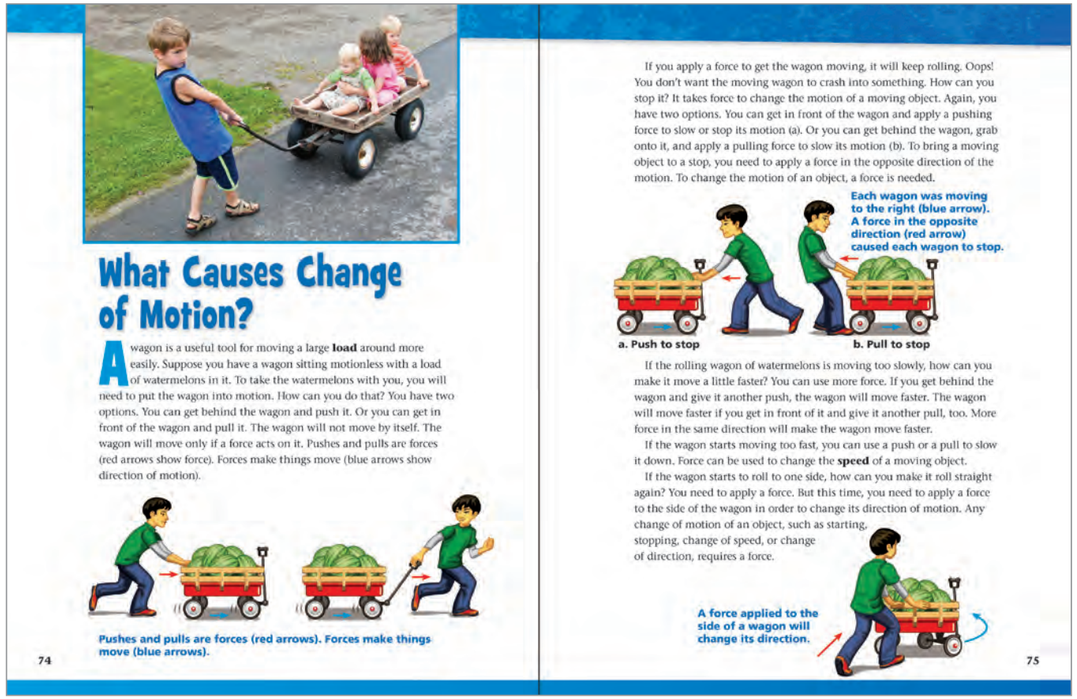
Entries from a kindergarten notebook

Vocabulary with context

FOSS takes students beyond scripted definitions, so they use science vocabulary in ways that show their understanding of the concepts the words describe. Students engage with scientific concepts through their senses during their active investigations. When they connect those experiences with the relevant vocabulary words, it gives the words a context and meaning that would otherwise be missed.

Reading informational text

Reading is an integral part of science learning, and students need to know how to read informational text critically and effectively. *FOSS Science Resources* books help teach literacy skills through reading materials that support and enhance the concrete, personal experiences the students are gaining in their active investigations.



What Causes Change of Motion?

A wagon is a useful tool for moving a large **load** around more easily. Suppose you have a wagon sitting motionless with a load of watermelons in it. To take the watermelons with you, you will need to put the wagon into motion. How can you do that? You have two options. You can get behind the wagon and push it. Or you can get in front of the wagon and pull it. The wagon will not move by itself. The wagon will move only if a force acts on it. Pushes and pulls are forces (red arrows show force). Forces make things move (blue arrows show direction of motion).

Pushes and pulls are forces (red arrows). Forces make things move (blue arrows).

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If you apply a force to get the wagon moving, it will keep rolling. Oops! You don't want the moving wagon to crash into something. How can you stop it? It takes force to change the motion of a moving object. Again, you have two options. You can get in front of the wagon and apply a pushing force to slow or stop its motion (a). Or you can get behind the wagon, grab onto it, and apply a pulling force to slow its motion (b). To bring a moving object to a stop, you need to apply a force in the opposite direction of the motion. To change the motion of an object, a force is needed.

Each wagon was moving to the right (blue arrow). A force in the opposite direction (red arrow) caused each wagon to stop.

a. Push to stop b. Pull to stop

If the rolling wagon of watermelons is moving too slowly, how can you make it move a little faster? You can use more force. If you get behind the wagon and give it another push, the wagon will move faster. The wagon will move faster if you get in front of it and give it another pull, too. More force in the same direction will make the wagon move faster.

If the wagon starts moving too fast, you can use a push or a pull to slow it down. Force can be used to change the **speed** of a moving object.

If the wagon starts to roll to one side, how can you make it roll straight again? You need to apply a force. But this time, you need to apply a force to the side of the wagon in order to change its direction of motion. Any change of motion of an object, such as starting, stopping, change of speed, or change of direction, requires a force.

A force applied to the side of a wagon will change its direction.

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A two-page spread from the grade 4 *FOSS Science Resources:* Energy

English language development (ELD)

Personal experiences that are meaningful to students, and which provide shared context for developing understanding, are critical components for ELD instruction. FOSS supports teachers with helpful ELD integration strategies across four key areas: activating prior knowledge, using comprehensible input, academic language development, and oral practice.

Spanish language resources

FOSS Next Generation supports Spanish speaking students and Two Way Immersion (TWI) schools through a variety of Spanish print and digital resources for students, including:

- *FOSS Science Resources* Spanish Edition print, eBooks, and audio books
- Spanish teaching slides for classroom facilitation
- Interactive whiteboard resources
- Module vocabulary and definitions
- Focus questions
- Most K–5 streaming video
- Ancillary postcards and card sets

FOSS: A vision fulfilled. Science teaching transformed.

Every student deserves the benefits of science education—not just exposure to scientific phenomena, but the opportunity to understand and explain them. From its foundation, FOSS was built to afford that opportunity to all, regardless of background culture, language, or ability.

The scholars at the Lawrence Hall of Science designed FOSS around the principle of collaborative, active investigation. FOSS effectively engages all students by inviting them to interact with observable phenomena, a teaching philosophy subsequently codified with the arrival of NGSS. FOSS makes science accessible and equitable for every student in every classroom. This active learning philosophy has turned two million students and 100,000 teachers into hands-on active investigators of scientific phenomena. FOSS is recognized today by experts and organization across the country for its proven quality, rigor, support, and effectiveness.

Learn more.

Find your local FOSS/Delta Education representative at **DeltaEducation.com/Sales**

FOSS™

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