

Using Literacy Strategies for Formative Assessment

All new SEPUP courses contain a variety of embedded strategies to support language literacy. These strategies can often be used to formatively assess students and to guide classroom instruction. Formative assessments are used to determine what students think or know. They can provide input that allows you to tailor your instruction to your students' needs. Some literacy strategies are well-suited to formative assessment. When students complete an anticipation guide or a concept map, you can review their work to see what they already know and what they may misunderstand.

Literacy in *Issues and Earth Science* Addresses the Needs of Diverse Learners

Nicole Buchanan, an 8th grade teacher at Pershing Middle School in San Diego, California, has been using literacy strategies embedded in SEPUP to support the diverse needs of her students.

One such literacy strategy, **talking drawings**, provides a way for students to demonstrate what they have learned using sketches and pictures. Nicole, who has been teaching SEPUP's *Issues and Earth Science* has used this strategy to help the English Language Learner students in her classroom.

First, she asked students to visualize and draw what they knew about rock formation. Their pictures revealed their prior knowledge regardless of their English language fluency and provided a format for students to express their scientific understanding.

Nicole says, "Drawing pictures, physically moving things around—they could do that. As they did it, they started making connections and seeing the relationships. The language barrier wasn't as high anymore."

At the conclusion of the activity, Nicole asked students to modify their drawings to show their new understanding. She uses this strategy more frequently now since it challenges all of her students to communicate what they know.

Concept maps, another literacy strategy implemented in the SEPUP curriculum (see p. 6), can be used with index



8th grade students in Nicole Buchanan's class at Pershing Middle School in San Diego, CA use index cards to construct a concept map.

cards to meet the needs of kinesthetic learners who learn better through moving, doing, and hands-on experiences. Nicole asked her students to write each concept on a card, with a brief definition or picture. Then, together with the other students in their group, they manipulated the cards on a white board to show the connections between the concepts.

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For example, one literacy strategy embedded in SEPUP's newest course, *Issues and Earth Science*, is the **anticipation guide**, which is used as a pre-reading strategy and revisited after the reading has been completed. It asks students to react to a series of statements and indicate whether they think they are correct or not. These statements foreshadow key ideas in the reading and elicit students' ideas about the material. A quick review of students' responses lets you know what they already think or know about a topic and may suggest areas that you need to emphasize in discussions of the text. When students revisit their responses at the end of a reading and cite information from the text to explain how it either supported or changed their ideas,

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**New SEPUP Course
Issues and Earth Science
See details on p. 6**

Each issue of the **SEPUP News** now focuses on a topic particularly relevant to SEPUP teachers. Together they form a concise, up-to-date archive of the SEPUP approach to science education.

Past issues and their topics are:

Fall 2003	Assessment
Spring 2004	Inquiry
Fall 2004	Classroom Learning Environment
Spring 2005	Issue-Oriented Science

Please let us know if you're missing an issue and we'll be happy to send it to you.

E-mail us at sepup@berkeley.edu.

Director's Corner: What's Been Happening at SEPUP



It has been a busy year at SEPUP since our last issue in Spring 2005. I'd like to take this opportunity to update you on our new projects and staff.

In October, we were joined by new instructional materials developer, Sara Dombkowski. Sara is a former middle school teacher from West Seneca, New York, where she taught physical, earth, and life science to seventh and eighth grade students. In the short time she has been with us, she has already contributed to two units of the new *Issues and Earth Science* course.

We are happy to have Sara's help, because we are busy with many projects. With the publication this year of *Issues and Earth Science*, we will have a complete middle school sequence. This course continues SEPUP's issue-oriented approach, builds on our earlier work on inquiry and assessment, and expands our focus on literacy in science. (For a complete list of the units in *Issues and Earth Science*, see the box on page 6.) Our plans include a significant revision of *Issues, Evidence and You*, which will be released later this year as *Issues and Physical Science*. This updated version will include a new unit on "Force and Motion" and enhanced correlations to the National Science Standards for the physical sciences.

We are also working on two projects for the high school. With funding from NSF, we are in the early stages of developing a second high school course, titled *Science and Global Issues*. This new course, together with *Science and Sustainability*, will provide a complete two-year integrated science course. Students who complete this course will have the equivalent of a year of high school biology and a semester each of physics and chemistry.

With funding from the Department of Energy, we are collaborating with scientists, educators, and energy and transportation experts in developing a high school module on hydrogen and fuel cells (See photo on page 7). This module is currently in early classroom trials in the San Francisco Bay Area and in Northern California. Our partners in this Hydrogen Technology and Energy Curriculum (HyTEC) project include the Schatz Energy Research Center at Humboldt State University, leaders in hydrogen fuel cell research and development, and the Alameda-Contra Costa Transit District, whose fuel cell bus program will provide real-world examples of how a new technology is developed and tested.

Dr. Barbara Nagle, Director

Selected Bibliography on Literacy in the Science Classroom

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SEPUP Materials

SEPUP instructional materials include student books or pages, teacher's guides, and kits. The following are currently available:

- Science and Sustainability:** high school
- Issues, Evidence and You:** middle school
(available both as year-long course and megamodules)
- Science and Life Issues:** middle school
(available both as year-long course and megamodules; Spanish student materials also available)
- Issues and Earth Science:** middle school
(available both as year-long course and megamodules)
- 12 SEPUP Modules:** secondary school
(kit includes CD-ROM and transparencies)
- CHEM-2:** Grades 4-6
(Spanish student pages also available)

All SEPUP materials are produced and distributed solely by Lab-Aids®, Inc. (800) 381-8003
www.sepup.com

SEPUP Issues in the News:

Using Current Events to Support Reading and Literacy

Reading experts have observed that the development of reading skills is significantly enhanced when students are reading text for a clear purpose in an interesting and meaningful context. The personal, environmental, and societal issues in SEPUP provide a meaningful context. Finding these issues in current news articles provides a motivation for students to become engaged in reading. The news items below relate to issues found in SEPUP materials and thus encourage students to improve their literacy skills in order to learn the science content behind each issue.

Ethanol Could Reduce Fuel Need

Ethanol is an alcohol that is produced from corn or other plants and can be used for fuel instead of petroleum-based products. Currently it is used as a fuel supplement or fuel alternative, but the cost of production is high—both environmentally and economically. Scientists from Imperial College in London, Georgia Tech, and Oak Ridge National Laboratory in Tennessee have a plan to produce ethanol economically.

They propose building a biorefinery that would utilize a range of products, including fuels, foods, animal feeds, and other materials to produce what is known as biomass—a collection of plant matter such as trees, grasses, and agricultural crops and other biological material. Their goal is to use every part of the plant for biomass. They estimate that biofuels from their proposed biorefinery could supply approximately 30 percent of global energy demand in an environmentally responsible manner without affecting food production.

The issue of using biofuels such as ethanol is explored in the “Moving the World” unit of **Science and Sustainability**.

Mongoose Threatens Birds and Humans

Although there are no native mammals on the Hawaiian Islands, there are a lot of Indian mongooses. Plantation owners brought them from Jamaica in the 1800’s to control the rats that were destroying Hawaii’s sugar cane plantations. Unfortunately, the mongoose is diurnal and rats are nocturnal, so they had very little impact on the rat population. At that time, rats were already threatening the bird populations of the islands and the mongooses only added to the problem.

Currently, the mongoose population is out of control for several reasons: in Hawaii, it has no natural predators, males can reproduce at four months of age, and females give birth to 2 to 5 pups per year. They are a threat to humans because they carry a bacterial disease called leptospirosis in their droppings, which contaminates streams and water supplies. So besides destroying native birds, they also threaten humans.

Introduced species, their reasons for success, and issues in controlling them are investigated in the “Ecology” unit of **Issues and Life Science**.

Fishing with Ultraviolet Light

Researchers know that while humans see in three colors—red, yellow-green and blue—fish can also see a fourth color in the shorter wavelengths of the ultraviolet (UV) range. They see the UV light as a white glow. Fishermen have a new product that uses this sensitivity to UV light to attract more fish.

The liquid can be sprayed on fishing lures and bait to attract fish. While white light penetrates only a few feet underwater, UV light can penetrate up to one-half mile, thus attracting fish over long distances. The product contains titanium dioxide, a sunscreen ingredient that reflects the UV light underwater. The white-colored liquid dries quickly and will stay on a lure for two hours. It is nontoxic, odorless, and washes off with soap and water. “You catch three or four times more fish, and the biggest fish,” inventor Dr. Milan Jeckle said and other fishermen seem to agree.

The properties of sunlight, including ultraviolet light, are investigated in the SEPUP module, “**Energy from the Sun.**”

Transporting Nuclear Waste Generally Safe

Scientists from the National Academy of Sciences say highly radioactive nuclear waste can be transported safely, but if a shipment caught fire, dangerous radiation could be released. The U.S. Department of Energy is preparing a plan to transport approximately 70,000 tons of nuclear waste from 39 states to a proposed repository at Yucca Mountain in Nevada, if the facility gets a license from the Nuclear Regulatory Commission. However, the government’s plan for opening the Yucca Mountain facility has been delayed and it may not open until 2015 or later.

The department is planning for approximately 4,300 shipments over 24 years. Nevada officials predict that it would be more than that. Some scientists have warned that public anxiety over the shipments may cause property values to decline and tourist business to be lost along transport routes.

Risks associated with nuclear waste and the suitability of Yucca Mountain for nuclear waste disposal are investigated in the “Plate Tectonics” unit of **Issues and Earth Science**.

Supporting Student Writing:

A Literacy Strategy for Evidence and Trade-Offs

Students are often asked to write for the purpose of communicating information—to demonstrate that they can identify the important ideas in a reading, for example. Literacy strategies such as the **writing frame** can provide structure and guidance during the writing process.

A writing frame is an outline of what to write. It structures students' writing by providing writing prompts that outline the ideas that need to be expressed in the writing. These prompts can include headings, the beginning of a sentence, and/or a content list. The writing frame also includes space for students to complete the prompts. Writing frames are an excellent strategy to prepare students to write extended responses. They can be especially useful in teaching students how to write a response to a question that will be assessed with the EVIDENCE AND TRADE-OFFS Scoring Guide.

A sample writing frame used in Unit A, “Studying Soils Scientifically,” of **Issues and Earth Science** is shown on the next page. In this unit, students study the properties of different types of soils in the context of solving the problem of a school garden. In the last activity of the unit, students are asked to recommend a plan for improving the garden. They are expected to support their recommendation with evidence and identify trade-offs of their decision.

This sample writing frame does not refer to trade-offs, but instead refers to people who may disagree with the recommended course of action. This is because the writing frame is intended to simplify the writing process and provide student-friendly guidance at the middle school level. A writing frame for older students or those that have stronger language skills might include a prompt such as “The trade-offs of my decision are...”



Literacy Writing Frame with Sample Student Response

There is a lot of discussion about the issue of

how to fix the school garden so that plants will grow there.

My decision is that

we should mix in a different kind of soil that can hold more water

and nutrients than the school soil.

My decision is based on the following evidence:

First, we observed that the school garden soil has a lot of sand.

Second, we learned that organic matter contains nutrients that

plants need but the garden doesn't have enough.

Third, we found out that the soil from another garden with

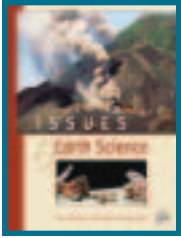
plants growing in it has more organic matter.

People who disagree with my decision might say that

it is expensive to buy soil to mix into the garden. Some people also

might think it's a lot of extra work.

New from SEPUP: *Issues and Earth Science*



How do Earth features influence where people live? What policies should guide our use of Earth's resources? How should we dispose of nuclear wastes? What kind of space exploration should we undertake in the future?

The science behind these and related issues is explored by students in *Issues and Earth Science*, part of a three-year comprehensive SEPUP science series for the middle grades.

Scope and Sequence

A. Studying Soils Scientifically	Students study the properties of different types of soils in the context of preparing a school garden. They investigate soil profiles, organic and inorganic components, use of fertilizers, and soil mapping.
B. Rocks and Minerals	Students investigate properties of rocks and minerals as they consider questions related to use of our natural resources. Physical properties of individual specimens, such as luster, hardness, and color, are investigated, as are rock types—sedimentary, igneous, and metamorphic—and how rocks change from one form to another in the rock cycle.
C. Erosion and Deposition	Students investigate the destructive forces of wind, wave, and water on landforms as they decide where to build homes. Stream tables and topographic maps are used to study river transportation, deposition of sediment and landform contours.
D. Plate Tectonics	Students explore the structure of the Earth—the core, mantle, and crust—and learn how the slow movements of large plates of the earth's surface help shape its features, including continents and oceans. They investigate earthquakes and volcanoes as they examine plans to dispose of radioactive wastes.
E. Weather and Atmosphere	Students investigate local and extreme weather conditions, climate, wind, and the water cycle, and examine the causes of weather and climate, such as the distribution of solar energy over the Earth. The atmosphere is also studied in depth.
F. Earth in Space	Students study the Earth's rotation, the causes of the seasons, movement of the moon, actions and causes of the tides, and review several calendars developed over the years to mark the passage of time.
G. Exploring the Solar System	Students explore the Earth's motion and position in the Solar System, our planetary neighbors in the night sky, gravity, remote sensing, relative and absolute distances, and issues in space travel.

Literacy for Formative Assessment

Continued from page 1

you can review their responses again to see what they learned from the text and be sure to address any problems they may have had.

Another useful literacy strategy is **concept mapping**. A concept map provides a graphic representation of the relationship among important ideas. In a concept map, the main concept or central idea is written on a page (sometimes within a circle) and subtopics are placed around it. A line is drawn to connect each subtopic with the central concept to show that there is a relationship between the two ideas. Subtopics can then be connected to other subtopics with additional lines and associated descriptions.

Each aspect of a concept map can provide information about student understanding of key ideas. Examine concept maps to make sure students understand which are the general concepts and which are the specific examples. If a concept map implies an incorrect understanding, write down inaccurate statements implied by the map. Have students discuss whether they agree or disagree with these statements and why.

For example, students may have constructed a concept map on basic chemistry concepts such as atoms and molecules. One student's map may suggest that water *contains* molecules, rather than the fact that water *is* a molecule. Ask students whether they agree with the statement: "Water contains molecules." Have them explain why this statement is or is not correct, and how the statement could be revised for increased scientific clarity.

Reinforce the relationship among key ideas by asking students where other specific examples of an idea fit on the concept map. For example, you could ask where other molecules, such as ammonia, would fit onto the concept map.

In these ways, you can use literacy strategies to drive classroom instruction and improve student understanding. By monitoring student work, you can prepare students for summative assessments (those used to evaluate student learning after instruction) and make sure they correctly understand those ideas on which they will be assessed.

HyTEC in the Classroom



These students in an Arcata, California high school chemistry classroom are using activities and equipment developed through SEPUP's collaboration with engineers at the Schatz Energy Research Center at Humboldt State University. This HyTEC project, (Hydrogen Technology and Energy Curriculum) is funded by the Department of Energy, and it presents the science of hydrogen fuel cells in the context of chemistry topics such as oxidation/reduction reactions and energy.

SEPUP Academy

Improve your use of SEPUP materials at the 2006 SEPUP Academy. This three-day conference will be held in Silverthorne, Colorado from June 20–22. Conference sessions will be led by senior staff of Lab-Aids and SEPUP and are designed for teachers and administrators implementing SEPUP.

In addition to a series of core sessions on inquiry, assessment, literacy, and issues in SEPUP, the program will include electives on topics such as leadership in SEPUP, writing effective grants, and SEPUP research and evaluation.

Visit www.sepup.com, to download a brochure for more information or contact Ayse Frosina at Lab-Aids at 800-381-8003, ext 120 or afrosina@lab-aids.com.

A Word from Lab-Aids

Mark Koker, Director of Curriculum and Professional Development

Literacy in the SEPUP science classroom: a pleasant surprise with SEPUP!

Helping schools and districts implement new middle-level science programs is a task not without its fair share of surprises. One of the pleasant surprises I've had the last couple of years has to do with how enthusiastically the literacy support in SEPUP is received by local teachers. Not that I am surprised when teachers say good things about the program—on the contrary, I am surprised when I do NOT hear positive comments from teachers. But in addition to hearing teachers rave about how their students like science and are engaged by the issue-oriented lessons, how the assessment program has really helped sharpen their views about student performance, and even how the kits make their lives so much easier—I hear more and more about the literacy support in SEPUP and its impact on teaching and learning.

Particularly with the new **Issues and Earth Science** materials, where the level of integrated literacy support is most explicit, teachers say that the approach taken in SEPUP is critically important. Science lessons are language lessons: each field of study has its own vocabulary, which includes special words and words from everyday discourse (like *power*, *wave*, *field*, and *mole*, all of which have different definitions in science as compared to everyday use)—so much so that science can be challenging for native and non-native English speakers alike. One study in the early 1990s suggested that students frequently confuse science terms with their antonyms!

That students can have trouble with informational texts is not surprising. But many have difficulty with procedural reading, e.g., following a lab procedure in a stepwise, logical manner. Also, in a recent workshop involving reading comprehension, teachers noted that students don't always come to class knowing how to discuss effectively with their peers. Just as we realized in the 1980s that putting students in groups of four did not always lead to productive, collaborative group work, we realize today that some students need help to get the most out of group discussions. That's why tools like **Discussion Web** and **Intra-Act** are now a part of your SEPUP literacy toolbox. Other literacy strategies in SEPUP were cited by adopting teachers in Clark County, Nevada (Las Vegas) as helpful for their district-wide AVID (college readiness) program.

I'm conducting my own informal poll to see what teachers would cite as the most effective literacy strategy in SEPUP. If you'd like to weigh in, or have a story you'd like to share, please contact me at mkoker@lab-aids.com.

Thanks for your continued interest in our work.

Literacy for Diverse Learners *Continued from page 1*

Nicole has found that “students have to be able to interact with the content or skill, and play with it and move it around. Once they do that, they have internalized it.”

Another strategy, **Stop, Listen, and Write**, provides direct guidance in synthesizing the main ideas of reading passages, and is particularly helpful for English Language Learners and students who need to improve their reading comprehension skills. After listening to a passage, students are asked to stop, (close their books if they were following along)

and write down the main idea of what was just read. These written pieces can serve as a formative assessment of the level at which students are understanding and processing material presented in readings. This strategy is built into several activities in IAES, but can easily be used with any selection of text.

It may not always be possible to meet the diverse needs of all students, but by including literacy strategies in the science classroom, more students will be able to grapple with new knowledge and communicate what they have learned.

SEPUP News

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Spring 2006

Calendar

Selected SEPUP Workshops

NSTA National Convention, Anaheim, CA

Friday, April 7

5:00–6:00 p.m. “Literacy Strategies in Earth Science” Janet Bellantoni, SEPUP Instructional Materials Developer, Laguna Room, Hilton Anaheim

Sunday, April 9

8:00–9:00 a.m. “Formative Assessment in Secondary Life Science,” Barbara Nagle, SEPUP Director, Room 204B Anaheim Convention Center

The following workshops at NSTA are sponsored by Lab-Aids®, Inc. They all take place in the Anaheim Convention Center.

Thursday, April 6

7:30–9:00 a.m. “What’s New from Lab-Aids?” Room 207B
9:30–11:00 a.m. “Sustain Your Students’ Interest with Science and Sustainability.” Room 207B
1:30–3:00 p.m. “Earth Science that Really Rocks!” Room 207B
3:30–5:00 p.m. “Put The Life Back Into Your Life Science With SEPUP!” Room 207B

Saturday, April 8

8:00–9:30 a.m. “Shining Some Light on the Science Standards.” Room 207D
10:00–11:30 a.m. “Beware of Physical Science That Isn’t!” Room 207D