



## SEPUP Assessment System Provides Powerful Tools for Teaching

**Research results from the University of California Berkeley Evaluation and Assessment Research Center show that students in SEPUP classrooms where the SEPUP Assessment System is used make much greater gains in achievement than those who do not use this system of embedded assessment.**

Teachers who implement the SEPUP Assessment System in their classrooms regularly find that it helps them set standards of performance and provides a way to communicate those standards to students. Using the system, especially for the first time, can present teachers with new challenges, but it is well worth the effort.

The components of the SEPUP Assessment System are described in all SEPUP Teacher's Guides. (See diagram below.) They include several *variables* that define areas of student learning over the year and a set of *scoring guides*, or rubrics, for each of these variables. (See example on p. 5.) Specific questions or tasks interspersed throughout the student materials are marked for assessment in the Teacher's Guides which also provide exemplars of student responses.

How to get started? First choose one or two variables that are important to you. Are you most interested in your students' inquiry skills? Then you may wish to

focus on the DESIGNING AND CONDUCTING INVESTIGATIONS or ANALYZING DATA variables. Are you more concerned about whether your students can use evidence to make personal or societal decisions? Then begin with the EVIDENCE AND TRADE-OFFS variable. Once you have chosen a variable, use an assessment blue-

print or unit overview (found in the Teacher's Guide) to find the embedded assessment questions for this variable.

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For more information about the SEPUP Assessment System, go to [sepuplhs.org/resources/assessment](http://sepuplhs.org/resources/assessment)

### Embedded Assessment and Portfolio Assessment Rolled into One!

*by Robert Baxter, Joan Bernobich, Kathaleen Burke, Cindy Degnan, Kai D. Lewis, and Jason Mayle from Buffalo, NY*

**The SEPUP Assessment System and portfolios are among the forms of assessment recommended by the National Research Council. (NRC, 2001)**

New York's Buffalo Public School District has been using a portfolio system for final assessment for several years now. Throughout the school year, our seventh and eighth grade students work on projects that are graded and placed into their "portfolios." The district recommends a variety of projects for teachers to offer to students.

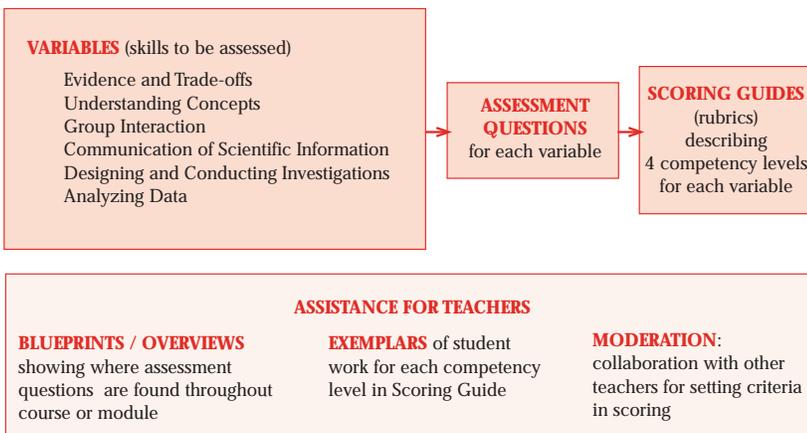
The problem that we first encountered was that we were trying to come up with the required portfolio projects for the district in addition to using the year-long *Science and Life Issues* (SALI) program. For a couple of years we brainstormed our way through the SALI course and came up with more than enough projects and activities to fulfill the district requirements. While this process was adequate, we were force fitting SALI activities into district requirements.

Last year, we decided to use the projects that naturally emerge from SALI as portfolio projects. This turned out to be a successful solution and has provided our students with many opportunities to master the important ideas and skills assessed by the SEPUP variables in SALI.

For example, students design and conduct several experiments throughout the course. This gives them a variety of opportunities to achieve a complete and

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#### COMPONENTS OF THE SEPUP ASSESSMENT SYSTEM



## Director's Corner: Evidence-Based Teaching



In these days of shrinking funding and growing concern about accountability based on inadequate tests, we find our usually cheerful colleagues sharing moments of uncertainty and worry about the future of education. At these times, it helps to remind ourselves why we are in science education and to return our focus to what matters most—our students and their learning. I'd like to encourage you to do three things that can help maintain your focus on what is important.

*First of all, listen to what your students are saying about science.* The focus on assessment in this issue of the *News* highlights some tools that can help you think about what students are saying and writing and use your observations to improve instruction and provide them with feedback. Not every assessment is formal or based on a written response—as you walk around the classroom, listen to your students as they try to analyze their results and answer the assessment questions. Expert teachers use these formative assessment opportunities to prepare themselves for leading follow-up discussions that respond to student ideas and help them to move forward.

*Second, talk to your colleagues about student learning.* Over and over we hear from

teachers who are happy in their teaching positions about how they feel connected to other science teachers in their school and even in other schools in their district. Assessment moderation is an ideal process for starting meaningful conversations about students' ideas. (See the article on p. 7) But if you don't have time for moderation, you might instead have a brief conversation about one topic you teach and what students seem to understand or have difficulty understanding. Or share a few examples of good student work or your ideas for adapting an activity for your school with a new teacher who will appreciate the input.

*Finally, don't let standardized tests, or even the standards, rule every decision about what is important to teach.* The standards are intended to help you focus on important content and scientific approaches, not drown you with a list of things to check off. The research community has provided abundant evidence that teaching fewer topics in depth and taking time for students to process what they are learning is more likely to encourage students to make connections and think deeply about science than trying to cover a wide range of disconnected facts that might be on a test.

Talking to your students and your colleagues about the content and processes of science can help you resolve some of the difficult decisions you make every week about what and how to teach for student understanding.

*Dr. Barbara Nagle, Director*

### Selected Bibliography of Assessment and SEPUP

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- Siegel, M.A., Hynds, P., Siciliano, M., & Nagle, B. (in press). *Using rubrics successfully: How to foster meaningful learning and self-assessment*. PEERS (Practical Experience and Educational Research) Matter. Washington, DC: Joint publication of NSTA and NARST.
- Wilson, M., & Sloane, K. (2000). From principles to practice: An embedded assessment system. *Applied Measurement in Education*, 13(2), 181–208.

For additional resources, go to [sepuplhs.org/resources/research](http://sepuplhs.org/resources/research)

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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 mega-modules)
- Science and Life Issues:** middle school (available both as year-long course and mega-modules)
- 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](http://www.sepup.com)

# SEPUP Issues in the News: Integrating Current Events into Assessment

Each Scoring Guide in the SEPUP Assessment System contains scoring levels from 0 to 4. A Level 3 score, which represents a “correct and complete” response, is an indicator of student success. Over time, some students will meet the criteria for a Level 3 and then “go beyond in some significant way” to receive a score of Level 4.

There are many ways a student can go beyond a correct and complete response, depending on the variable being assessed. For example, when using the EVIDENCE AND TRADE-OFFS variable, students can be assessed on their ability to use evidence to compare multiple options, make a choice, and evaluate the trade-offs of their decision. One way for students to achieve a Level 4 on this variable is by providing a correct and complete response which includes additional evidence not found in the student materials. Shown below are examples of recent news articles and the extent to which they can provide such evidence. Complete student exemplars of Level 4 responses can be found in your SEPUP Teacher’s Guide.

## Singapore Uses Quarantine in the Battle Against SARS

Although Singapore was declared free of Severe Acute Respiratory Syndrome (SARS) at the end of May 2003 by the World Health Organization, a Singaporean man who worked in a microbiology lab tested positive for SARS in early September. Immediately, 25 other people who had either worked or otherwise come into contact with him were put into home quarantine for 10 days. He recovered and the quarantined individuals did not show any signs of infection during their time of isolation. No other cases of SARS have been reported since then. Singapore has been extremely alert against a possible comeback of the virus. There is still no cure or vaccine for SARS.

**Science and Life Issues, Activity 34, “The Story of Leprosy”, Question 4**  
“...explain whether you think people who have an infectious disease should be quarantined. ...”

Students could use this news item to provide a recent example of the use of quarantine as a precaution in the case of a highly infectious new disease, although they may note that in this case, the quarantined individuals did not become sick.

## Solar Panels at the White House

In January 2003, the White House had 167 solar photovoltaic panels installed to help provide electricity and heat water. This reflects a gradual increase in the use of solar technology over the last two decades. The U.S. Energy Information Administration tracked shipments of photovoltaic modules from 1982 to 2001 and found that they increased fivefold. The relative cost of solar energy has decreased significantly due to technological improvements and mass production. Government subsidies have also provided an incentive to use solar power.

**Issues, Evidence and You, Energy Activity 7, “Electrical Energy: Sources and Transmission”**

**“Your city needs more electric power.... You have been asked to recommend a source of power. ...Which would you choose and why?”**

Historically, one of the greatest barriers to the use of solar photovoltaic energy has been cost. This report suggests that the cost of solar power may have decreased enough to make it more competitive with other energy sources.

## Fast-Food Restaurants Spreading Across China

The U. S. Department of Agriculture Foreign Agricultural Service reports that there is an increasing number of fast food restaurants across east China. Fast food restaurants such as Kentucky Fried Chicken and Japan’s Mos Burger are gaining popularity, in part because they are affordable. McDonald’s has launched a plan to open 100 new restaurants per year in China. Locally-based fast food chains are also expanding. This rapid increase in fast food consumption has emerged only in the last 10 years. Over the next few years, an even larger number of fast food restaurants is expected to open in China.

**Science and Sustainability, Activity 11, “Eating Patterns Around the World,” Question 5**

**“...Which of these countries [United States, Italy, China, India] has the most sustainable eating habits? ...”**

This news item provides evidence for students to reasonably project that average food consumption in China is moving towards an American diet. This projection can influence students’ evaluation of the future of sustainable eating habits across different cultures.

## Lawsuits Over the Threat of MTBE to Drinking Water

The county of Sacramento, California, along with water utility companies, is suing major gas companies over potential contamination of the area’s groundwater. They claim that companies doubled the amount of the additive MTBE in gasoline to meet the requirements of clean air laws without telling the public that MTBE is a threat to drinking water. The lawsuit is unusual because it claims damages for the threat to drinking water wells, rather than their actual contamination.

**Investigating Environmental Health Risks Module, Investigation 8, “Evaluating Risk,” Question 5**

**“...Do you think MTBE should be banned?...”**

The environmental and health effects of MTBE are not fully known. This lawsuit suggests that the potential harm caused by MTBE ingestion may be extremely serious, but does not provide any scientific data. Because it does not give additional evidence regarding MTBE, it does not meet the criteria of the Scoring Guide and could not be used to achieve a Level 4 score.

# Sample Activity: Using the SEPUP Assessment System

The SEPUP courses use all the variables of the SEPUP Assessment System to track student progress regularly throughout the year. Because of the limited time frame of the SEPUP modules (4–6 weeks), each module focuses on only one of the assessment variables. Each module contains three to five questions designed to be assessed using a single SEPUP Scoring Guide.

The following student activity is excerpted from the recently revised module “Hazardous Materials Investigations: The Barrel Mystery.” This module focuses on the ANALYZING DATA (AD) variable, and we recommend scoring Question 4 with the AD Scoring Guide. In the SEPUP modules and *Science and Sustainability*, ANALYZING DATA is a variable, while in the middle school courses (SALI and IEY), it is an element of the DESIGNING AND CONDUCTING INVESTIGATIONS variable.

## Planes, Trains, and More

### ••••► CHALLENGE

**How will you transport the simulated hazardous waste?**

What is the safest way to transport hazardous waste? Use data presented in the following reading to determine the safest way to move the barrel to a disposal site hundreds of miles away.

### ••••► READING

...Every year, millions of tons of hazardous materials are transported from one part of the country to another. These materials may be used by industries to produce new goods (such as circuit boards) or to provide services (such as dry cleaning). Some hazardous materials are sold directly to consumers for purposes such as cleaning (bleach, for example) or to run other products (cars require motor oil, for example).

When such hazardous materials are accidentally released into the environment in large quantities, they can cause serious problems. How common are such accidents? It depends on the mode of transportation. Some materials are transported by trucks on highways, while other materials are transported by airplanes, trains, or ships. The table below shows the number of accidents involving hazardous materials by each mode of transportation. Not all of these accidents were fatal. Look at the columns which show the number of injuries and deaths from each of mode of transportation.

Mode of Transportation	Estimated Number of Shipments	Number of Hazardous Materials Accidents in 2000	Number of Injuries in 2000	Number of Deaths in 2000	Percentage of Shipments That Resulted in Accidents
Air	88,000	1,420	5	0	
Highway	1,200,000	14,943	156	12	
Railway	13,000	1,053	82	1	
Water	700	15	0	0	

### ••••► ANALYSIS

**Individual**

4. What mode of transportation would you recommend for transporting your hazardous waste to a disposal site? Support your answer with evidence.

## Assessment Question:

What mode of transportation would you recommend for transporting your hazardous waste to a disposal site? Support your answer with evidence.

## Scoring Guide: Analyzing Data (AD)

<b>Level 0</b> <i>None</i>	Your response is missing or not relevant.
<b>Level 1</b> <i>On your way</i>	<ul style="list-style-type: none"><li>• You identify evidence and/or</li><li>• You explain what you think the evidence means.</li></ul>
<b>Level 2</b> <i>Almost there</i>	<ul style="list-style-type: none"><li>• You explain what you think the evidence means.</li><li>• You use some evidence to support your ideas.</li></ul>
<b>Level 3</b> <i>Complete and correct</i>	<ul style="list-style-type: none"><li>• You use evidence to support a logical interpretation of the data.</li><li>• You evaluate the source, quality, and/or quantity of evidence.</li></ul>
<b>Level 4</b> <i>Above and beyond</i>	<p>You accomplish Level 3 and go beyond in some significant way such as:</p> <ul style="list-style-type: none"><li>• You present a thorough examination of evidence.</li><li>• You connect your ideas with the science concepts learned.</li><li>• You provide an explanation for why alternative ideas were discarded.</li><li>• You provide suggestions for further relevant investigations.</li><li>• You include a diagram or visual to clarify your ideas.</li></ul>

## Student Exemplars

### Level 1

Choose the one with the lowest number of accidents that year.

### Level 2

Sending things by ship is the best. Ships had the fewest number of accidents and no injuries or deaths in 2000.

### Level 3

I recommend using the highway. It had the lowest percentage of accidents in 2000. The highway had 1.2% accidents compared to 2.1% on the water. This means that if there were 100 shipments by water, there might be two accidents. If there were 100 shipments by highway, there might be only one accident. So even though transportation by water had the fewest number of accidents, it was not likely to be safer. It would help to have data from other years to make sure that this is true every year.

### Level 4

Air transport is the best because there were no deaths and a low percentage of accidents (1.6%). We should find out the number of accidents each year for five years and calculate the average number of accidents per year. I bet that air transport would have fewer accidents and deaths on average.

## Scoring Rationale

*Student identifies that the number of accidents in a year is important evidence for making the decision but does not elaborate any further or state which form of transportation has the fewest accidents.*

*Student recommends a form of transportation to use and provides some evidence in support of this form of transportation. It is not a Level 3 because the level of analysis is fairly minimal, and there is no evaluation of the source, quality, and/or quantity of evidence.*

*Student recommends a form of transportation to use and provides an analysis involving a comparison of the percent of shipments involved in accidents. In the final sentence, the student also evaluates the quantity of evidence.*

*Student recommends a form of transportation to use and provides statistical evidence in two categories—deaths and the percent of shipments involved in accidents. The student also evaluates the quantity of evidence but goes beyond by suggesting what additional evidence would be useful and how it could be used.*

## 6th Grade Earth Science Field Test



**This fall, SEPUP began its year-long field test of its 6th grade earth science course, currently called Science Processes and Issues in Earth Science (SPIES), at centers near Buffalo, NY, Winston-Salem, NC, and Vista, CA.**

The field test kicked off with a teacher training conference at the Lawrence Hall of Science in Berkeley, CA in July. At the conference, field test teachers were trained in the SEPUP approach, became familiar with the SPIES materials, and collaborated with the developers. Field test teacher Corean Lofton from Westminster Community School 68 in Buffalo commented on the training, "I have learned so much this week... SEPUP has broadened my horizons." (Her students are shown above doing the first activity of the Minerals and Rocks Unit.) John Cardarelli of Jefferson Middle School in Winston-Salem said, "In my 19 years of teaching, I rarely felt so respected and listened to in the course of training. This field test training has been professional collaboration of the highest caliber." Field test teachers will be returning to Berkeley in January for follow-up training with the second semester material.

**Interested in field testing for SPIES during the 2004-05 school year? Look for the application at our website at [www.sepuplhs.org](http://www.sepuplhs.org) or e-mail us at [sepup@uclink.berkeley.edu](mailto:sepup@uclink.berkeley.edu)**

### SAMPLE COMPONENTS OF SALI STUDENT PORTFOLIO

Understanding Concepts (UC)	Evidence and Trade-offs (ET)	Designing and Conducting Investigations (DCI)	Communication (CM)
24 Laboratory: Round and Round	11 Talking It Over: Sick Day	9 Laboratory: Data Toss	18 Modeling: The Circulation Game
31 Project: The Range of Diseases	20 Role Play: Great Aunt Lily's Will	14 Laboratory: Breakdown	29 Project: Helping Hearts
44 Investigation: Who's Who	72 Talking It Over: The Miracle Fish	64 Laboratory: Nature and Nurture	67 Talking It Over: What Would You Do?

### Assessment Portfolios

*continued from page 1*

correct (Level 3) score on the DESIGNING AND CONDUCTING INVESTIGATIONS variable by the end of the school year. Because SALI offers so many activities containing embedded assessments, students are able to choose their best work to include in their portfolio. Since each variable will be assessed several times during the school year, a student who isn't successful with a single portfolio piece can use other work to improve his or her score.

An advantage for teachers is that there is no extra work involved with creating student portfolios. Portfolio pieces are drawn from activities and projects already in the SALI course with ready-to-use Scoring Guides provided in the Teacher's Guide. The activities and Scoring Guides have been nationally field-tested and are proven to work. Constructing the portfolio around SALI activities makes assignments easy to implement and customize based on the interests and needs of both teachers and students.

Each student's portfolio consists of three projects, or assessment tasks, for each of the following variables: UNDERSTANDING CONCEPTS, EVIDENCE AND TRADE-OFFS, COMMUNICATION OF SCIENTIFIC INFORMATION, and DESIGNING AND CONDUCTING INVESTIGATIONS. (The GROUP INTERACTION variable is scored throughout the year and is used to monitor a student's ability to work in groups, but is not used for a portfolio score.) An example of the SALI assessments used for a portfolio is shown below to the left.

For examples of student work and more information on these portfolios, go to [westminstercs.org/baxter/sali/saliassessmentvariables.htm](http://westminstercs.org/baxter/sali/saliassessmentvariables.htm)

The portfolio score is added to a student's year-end exam to give the final grade. In our experience, these SALI portfolios show a high student success rate along with a sense of ownership and pride in class activities and projects. By integrating SEPUP curriculum with our local goals, we have created the perfect balance of student achievement and ease of work for the teacher. Teachers using SALI can learn from our experience and create working portfolios that showcase student work for the student, their parents, and local administrators.

## Assessment Moderation: Teachers Work Together

**Can five teachers agree on the same score for a piece of student work? If they are involved in a SEPUP assessment moderation session, they can.**

In a moderation session, several teachers work together to score a sample of their students' work using the SEPUP Scoring Guides. The goal of moderation is to reach consensus on the scores for each student sample through discussions and negotiations. Moderation groups encourage teachers to share their instructional and assessment practices, and they provide a forum for resolving practical concerns in using the curriculum and the SEPUP Assessment System.

To start a moderation group, you need four to six classroom teachers who have taught and initially scored student work on the same activity and a leader to facilitate the meeting. Teachers don't need to be at the same school, but there is more common ground for fruitful discussions if teachers are using the same curriculum. After you have scored your own students' work and your colleagues have done the same, the meeting begins as all the scores are recorded on an overhead. Then each teacher discusses his or her rationale for the initial student score. The group must reach consensus on each score.

At moderation meetings, common questions are, "How specific does an answer need to be?" and "Must a Level 3 response include scientific terminology?"

The moderation process brings home the idea that student scores must be based on evidence in the student work. It addresses the question: "Why is my score different than the other teachers' scores on this student's paper when we all used the same Scoring Guide?"

After participating in a moderation session, teachers often have new ideas for their classes, such as re-teaching a concept with a different approach, or reviewing the Scoring Guides with students and having them peer assess their work.

Moderation meetings help teachers to support each other as they work together to solve daily challenges. Teachers involved in moderation meetings become even more committed to using Scoring Guides to assess and foster their students' learning.

### A Word from Lab-Aids

Mark Koker, Director of Curriculum and Professional Development

We are pleased to announce that this past year, several major school districts decided to implement SEPUP programs, and we'd like to tell you about some of them.

After an extensive pilot and a long review process, **Tacoma (WA) Public Schools** adopted **Science and Sustainability (S&S)** as the freshman science class for all students in the district. Teachers took part in an August training workshop at Lincoln High School, led by Mark Klawiter, who hails from Ladysmith, WI. Local teachers Ginny Redher, Linda McColl, and Jim Stephens not only helped out in the workshop, but they helped design the workshop outline in initial pre-training meetings with Donna Parker from Columbus. Initial reactions to the workshops and the S&S materials have been very positive.

Seventh grade teachers in the **San Diego Public Schools** will begin using the **Science and Life Issues (SALI)** program this year, after a decision to adopt the program city-wide. Use of the "Analyzing Instructional Materials" (AIM) process of the National Academy for Curriculum Leadership (NACL) as part of the pre-selection routines resulted in a score for SALI of 92/100—among the highest scores ever for a program of this type, according to Jim Short, NACL Director. "We are excited about using inquiry-based materials in our middle school classrooms," said Tammy Wu and Don Whisman, science resource teachers with the District. "Students are engaged in active learning and are applying their understanding of science concepts to real-life issues."

Chicago seventh and eighth grade teachers attended a week-long workshop series at Loyola University in August, led by Dick Duquin and Kathy Burke, and sponsored by the **Chicago Math and Science Initiative (CMSI)**, a large-scale effort to reform science and mathematics instruction in the city schools over the next five years. "We're really excited to use the SEPUP programs as key elements of the Chicago Math and Science Initiative," said Michael Lach, CMS Director of Science for the Chicago Public Schools. "... the kit-based issue-oriented approach has our kids really excited about doing science."

### Assessment System Provides Tools for Teaching *continued from page 1*

Choose a small number of assessment questions to assign, read and score.

Allow a week or two between assignments, so you will have time to review student work. Scoring is time-consuming at first, but teachers find that they learn to do it much more quickly over time. Be sure to share the Scoring Guides, student scores, and comments with your students. To get the most out of the system, give students a chance to revise their work and raise their scores.

As you and your students become more experienced with the system, you can add more variables and assessment questions. You can also enhance the effectiveness of the system by working with your colleagues or students to adapt the Scoring Guides to your students' needs by re-writing them, for example, in student-friendly language.

Consider working with a group of teachers to conduct assessment moderation, in which you score a common set of papers and discuss the scores to reach a consensus on your interpretation of the Scoring Guides. (See article on this page.) You will be surprised at the new insights you will gain on student thinking when you discuss your students' answers with other teachers.

#### How has SEPUP facilitated the use of inquiry in your classroom?

"Inquiry" will be the focus of a future issue of the **News**, and we would like to include your class.

Write to us at  
sepup@uclink.berkeley.edu

Tell us how you have used SEPUP materials to stimulate inquiry with your students.

# SEPUP News

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Fall 2003

## Calendar

### Selected SEPUP Workshops

- December 4-6** NSTA Western Regional Convention, Reno, NV  
“Learning About the Learning Cycle,” Dr. Herbert Thier. Featured presentation.  
Thursday, December 4, 3:30-4:30 p.m.  
“Examining the Benefits and Trade-offs of Mining,” Daniel Seaver  
Friday, December 5, 11:00 a.m.–noon, Room A4, Reno-Sparks Convention Center

Look for other SEPUP workshops this fall at the following meetings and events:

- |                      |  |              |
|----------------------|--|--------------|
| <b>October 9-11</b>  | California Science Teachers Association            | Long Beach   |
| <b>October 14-15</b> | New Jersey Science Teachers Association            | Somerset     |
| <b>October 14-15</b> | Arizona Science Teachers Association               | Mesa         |
| <b>October 16-17</b> | Iowa Science Teachers Association                  | Des Moines   |
| <b>October 16-17</b> | Illinois Science Teachers Association              | Peoria       |
| <b>October 16-18</b> | Florida Science Teachers Association               | Jacksonville |
| <b>October 23-25</b> | Nebraska Association for the Teaching of Science   | Omaha        |
| <b>October 23-25</b> | Alabama Science Teachers Association               | Hoover       |
| <b>Oct 30-Nov 1</b>  | Conference for the Advancement of Science Teaching | Houston      |
| <b>November 5-7</b>  | Massachusetts Science Teachers Association         | Worcester    |
| <b>November 6-8</b>  | Kentucky Science Teachers Association              | Lexington    |
| <b>December 3-5</b>  | Pennsylvania Science Teachers Association          | Hershey      |