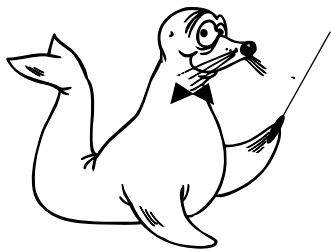


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Presenting SEPUP

A Workshop Guide

The Science Education for Public Understanding Program

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Introduction

1 Rationale for This Guide

This guide is a tool for your use and is designed specifically to help you lead workshops on SEPUP instructional materials. As a SEPUP workshop leader, one of the primary tasks you will have is to introduce teachers to SEPUP and its issue-oriented approach. Many sections of this guide will provide you with important aids to workshop planning, as well as an understanding of the unique elements of SEPUP programs.

As part of becoming a competent SEPUP workshop leader, it is important that you assess your own workshop presentation skills. Self-assessment will help you grow in these skills. After completing a SEPUP workshop, it is suggested that you reflect upon your experiences and record your responses in a journal so that you can see your growth over time.

2 Leadership SEPUP-Style

There has been a great deal written about leadership, but perhaps the most applicable definition as it relates to SEPUP is “taking responsibility for something you care about.” When SEPUP first started, many teachers who saw its positive effect on their students wanted to share their ideas with their colleagues on a grassroots level. The word spread; and this process has evolved to become SEPUP’s leadership programs. This is the finest example of “taking responsibility for something you care about.”

With the growth of SEPUP, it has become necessary to develop a more structured format to develop teacher-leaders for the many programs under the SEPUP umbrella. Throughout this development, we have maintained the understanding that to be an effective SEPUP leader it is necessary to have a vision that you want to share with others—the vision of what SEPUP can do. It is this vision that you need to communicate to your colleagues so that they can begin to internalize it and use it naturally as part of their science teaching.

To have this work effectively requires teacher change. The process of change by the teachers you work with is a highly personal experience that involves developmental growth in their feelings and their skills. It will be your job as a leader to help your colleagues become receptive to this change by listening to their concerns and ultimately by having them view you as being nonjudgmental, understanding, and sincere. In your role as a leader, you will need to demonstrate natural kinds of leadership ability. You do this when you show empathy toward the teachers with whom you work, when you demonstrate a willingness to reflect on ideas presented, and when you work collaboratively with the teachers by accepting and offering constructive criticism. You do this when you create the spark and excitement for SEPUP by providing a clear issue-oriented focus for their understanding of the program. You do this when teachers are bound together by the common aspiration of presenting exciting materials that will turn their students on to learning science. You do this when teachers become truly committed to internalizing those goals in a very personal way. In this way, you help them become leaders in their school and community.

3 A Shared Vision

Understanding why SEPUP is not just another hands-on science program is key to creating a shared vision and purpose with your colleagues. You need to understand these important aspects of SEPUP and communicate them frequently to your colleagues in both formal workshop settings and informal peer coaching sessions.

The important underpinnings of SEPUP link directly to the idea that this is an issue-oriented program; what the students are studying is directly linked to issues they can read about in the newspaper, find on the Internet, or see on television. This is a very powerful part of the program because it makes learning relevant to the student: the decisions they make based upon the evidence they collect can become an important part of their life. In addition, students learn that decisions are dynamic and all-encompassing and require their judgment when it comes to looking at evidence with respect to trade-offs and risk. Students learn that sometimes there is a very fine line between science and public policy, especially when it comes to decisions like “When is a lake polluted?”

In addition, leaders need to communicate the idea that participating in issue-oriented science means that the classroom will be a very different place because teachers will have instructional opportunities they would not have with other science programs. These changed instructional opportunities will substantially alter what the classroom will look like, how teachers will teach, and how their students will perform.

You and your colleagues will have the opportunity to become facilitators of learning in order to help students take responsibility for their own learning in collaborative groups. You will not be the lone purveyor of facts, but rather the enabler that helps students to gather their own information. Teachers will understand the value of asking open-ended questions to encourage dialogue among the students. Using the 4-2-1 cooperative learning model designed by SEPUP for materials-centered science, teachers will design learning environments that encourage independent learning.

All students will have the opportunity to be successful and be able to achieve to their maximum potential in the SEPUP classroom, because the issues they study will be strong motivation for their learning. SEPUP will help level the playing field for all students, no matter how ethnically diverse, since the hands-on activities provide a common experience for all. Students will understand the connections between the subjects they are learning as science becomes more integrated with other disciplines. They will learn that the processes of science need not be confined only to science because they will understand how to use evidence as a powerful tool in other subject-matter contexts, such as literacy.

Finally, this dynamic change in the students' learning experiences will be reinforced in their classroom experiences through the use of embedded and authentic student assessments that their teachers will use to inform further instruction.

4 The SEPUP Approach

The SEPUP approach to science teaching involves activities and investigations, discussions and debates, and themes and questions. Learners experience the relation of science and technology to social issues as they gather and evaluate scientific evidence, assess risks and benefits, ask questions, and make decisions based on evidence rather than emotion.

As a result, students begin to appreciate both the power and limitations of science and to understand that science is a way of asking questions rather than a set of answers to be learned. In this way, SEPUP encourages the development of scientific literacy, which is so vital to effective participation in today's world.

SEPUP's Goals

- To develop learner-centered instructional materials that enhance the role of students as independent thinkers and active participants in science.
- To design a model for upper elementary and secondary school science reform that is flexible and responsive to local school needs and appropriate for students of all ethnic, cultural, and socioeconomic backgrounds, especially students at risk.
- To provide educational experiences focusing on science and technology and their interaction with people and the environment.
- To promote the use of scientific principles, processes, and evidence in public decision-making.
- To build and expand existing SEPUP partnerships with industry and the public sector for the financial and intellectual support of the development and use of issue-oriented science materials and programs in the schools.
- To enhance the role of teachers as facilitators of student learning and as educational leaders within their communities by having them share in the development, implementation, and assessment of issue-oriented science materials and programs.

5 A History of SEPUP

SEPUP began in 1983 as a project to develop materials about chemicals and their use for schools and community groups in the state of California. Intended as a partnership between the state legislature and industry, the project—then called the Chemical Education for Public Understanding Project (CEPUP)—never received any financial support from the state. Funded primarily by the chemical industry in California between 1983 and 1987, the small pilot project developed materials about chemicals and their uses in society for both school and community groups in

California. Growing national interest in the materials and their “issue-oriented approach” resulted in 1986 in a proposal to the National Science Foundation (NSF) to develop materials for both schools and the community. This initial proposal was refused. In 1987, NSF funded a second proposal to develop the CEPUP Modules for use in the schools. Since that time, all work with community groups has been supported by private-sector grants. In 1992, field-based interest in full-year, issue-oriented science courses resulted in NSF funding for the development of *Issues, Evidence and You* and *Science and Sustainability*. At that time the name of the program was changed to the Science Education for Public Understanding Program (SEPUP), and Lab-Aids Inc.[®] became the publisher and producer of SEPUP materials. Subsequent NSF grants are currently funding the production of *Science and Life Issues*, SEPUP’s middle-school life science course, and the revision, in partnership with Lab-Aids[®], of the SEPUP modules. Two major NSF Teacher Enhancement grants have helped develop the local leadership essential to the success of the SEPUP approach.

During the same period (1989 to present), major private-sector funding has supported the development and dissemination of *Chemicals, Health, Environment and Me* (CHEM), SEPUP’s issue-oriented science enrichment program for grades 4–6.

SEPUP Instructional Materials

6 Elements of SEPUP Instructional Materials

There are many elements to SEPUP instructional materials that reflect SEPUP's unique philosophy. These elements include a focus on issue-oriented science, evidence-based decision-making, trade-offs and risk, inquiry, and a 4-2-1 model of cooperative learning; embedded assessments; and teacher-based materials development.

→ Issue-Oriented Materials

The personal and societal issues at the heart of all SEPUP products provide a framework for the hands-on investigations, discussions, simulations, and readings that comprise SEPUP instructional materials. These issues are not add-ons appended as an afterthought to the “real content” of a SEPUP module or unit, but are instead an integral part of every activity sequence. SEPUP activities take place in the context of issues that are of interest and relevance to students, their families, their communities, and their role as members of the global community. Students find that many of the issues they are studying appear frequently in the newspaper, on television news programs, and, at times, on the ballot during elections. These issues provide opportunities for students to learn important science concepts and apply these concepts and the principles of evidence and trade-offs to decision-making.

→ Evidence-Based Decision-Making

One of SEPUP's goals is for students to make decisions that are based on thoughtful analysis of scientific evidence. In order to accomplish this goal, students need experience collecting evidence through observations, experiments, and investigations of printed material and other sources. They must learn key concepts in science as well as how scientists have obtained and used evidence to formulate these concepts. Students can then participate with their classmates in decisions that are related to the science they have learned. In SEPUP materials, students are given opportunities to make these decisions through discussion, debate, role-playing, and other activities that reflect personal and societal decision-making processes. SEPUP is a non-advocacy

program; it does not teach students which decisions to make. Instead, it provides the necessary knowledge and understanding so that individuals can more effectively make their own decisions.

→ **Trade-offs and Risk**

As in real life, nearly all the decisions that students are asked to make in SEPUP materials require that they face the issue of trade-offs. They learn that in reaching the best possible solution, they must weigh the benefits and risks of different decisions and make trade-offs to come to a final decision. The risks and benefits may include health, environmental, economic, political, or social factors. At this point, people's differing points of view and emotional responses come into play. Science provides evidence, but people make decisions, and each person makes trade-offs based on his or her personal preferences and point of view. A common understanding of the science and technology involved encourages thoughtful, meaningful, and productive classroom interactions regarding both the available evidence and the decision-making process. SEPUP avoids advocating any specific decisions, but instead encourages students to make their own decisions by applying the concepts of trade-offs and risk and an understanding of the scientific evidence related to the issue. It is important for you as a workshop leader to understand the concept of trade-offs and risk, since it is a theme that runs through much of SEPUP.

→ **Guided and Open-Ended Inquiry**

Both guided and open-ended inquiry approaches are used in SEPUP, depending on students' prior experiences and the learning goals of the investigation. When the goal is to be certain that students have particular experiences to help them build an understanding of scientific principles, a guided inquiry approach is valuable. This ensures that everyone in the class has an opportunity to master the ideas that are key to an understanding of a scientific concept or issue. When the goal is to give students experiences in designing and conducting their own investigations, asking meaningful questions and searching for answers, or more open-ended critical thinking, a more independent and open-ended inquiry approach is used. These approaches are complementary; the guided inquiry experiences and discussion of these experiences give students a foundation for more open-ended inquiry activities. SEPUP products are developed to include a planned progression from guided inquiry activities to more independent, open-ended inquiry experiences.

→ 4-2-1: Cooperative Learning Based on the Way Students Learn

SEPUP's approach to cooperative learning is based on the belief that learning is an interactive process, in which students learn through observations and discussions about hands-on activities and other experiences in the classroom and by relating these to prior experiences and understanding. The 4-2-1 cooperative learning model recommended for use with SEPUP materials facilitates interactions among students and between students and the teacher. It also facilitates classroom management and is a cost-effective way to provide hands-on experiences for all students.

The term 4-2-1 refers to the way students interact with the materials and each other in the SEPUP classroom. The "4" in 4-2-1 refers to the grouping of students into a group of four that will share some of the activity materials, discuss procedures, and discuss results of their investigations. The "2" refers to the two teams of students within each group of four. In most activities, essential materials are provided for each pair of students to complete the procedure. The "1" in 4-2-1 refers to the individual student. The individual student is expected to keep his or her own record of the activity, write answers to related questions, and be fully responsible for understanding all procedures, making and recording observations of results, and interpreting and analyzing the investigation.

For example, many activities involve use of the SEPUP tray—a molded plastic tray that provides numerous wells for microscale laboratory work. Each team of two students in a SEPUP classroom shares a tray, allowing each student a chance to actually manipulate the laboratory materials and to discuss their observations and ideas with a partner. This team of students shares chemical solutions and other materials with the other pair of students in their group of four. This helps reduce the overall cost of the laboratory materials, while at the same time providing an opportunity for on-task peer interactions. As the activity proceeds, the two teams of students can compare results, look for similarities and differences, and discuss their activities. They are able to do this in an informal grouping that fosters opportunities for students to modify and refine their ideas as an activity proceeds. Each student can also record his or her own ideas independently, and students are not forced into agreeing with the majority.

Many other forms of cooperative learning place students in artificial roles, such as timekeeper, materials manager, etc. These roles can be helpful at times, but assist in classroom management rather than promoting student learning. Instead, the 4-2-1 model fosters student engagement with the materials and with each other. It also

provides an opportunity for the teacher to interact with students at both the group and individual level. In SEPUP classrooms, 4-2-1 provides a cooperative learning design in which students are cooperating to learn, not just learning to cooperate.

→ **Embedded Assessments**

SEPUP's year-long courses include an embedded assessment system that has been developed in collaboration with researchers at the School of Education at the University of California, Berkeley. This system is based on embedded assessments that are integrated into the instructional materials and are virtually indistinguishable from the day-to-day classroom activities. These assessments are developed and field tested along with the instructional materials and are an integral part of the learning experiences provided by SEPUP courses. The SEPUP Assessment System includes three central components:

1. The SEPUP variables, which form the framework of the instruction and assessment
2. Specific assessment tasks embedded in the instructional materials and linked to the SEPUP variables
3. Scoring guides for scoring and interpreting student work

Within the SEPUP Assessment System, there are five variables: Understanding Concepts; Designing and Conducting Investigations; Evidence and Trade-offs; Communication of Scientific Information; and Group Interaction. Each assessment task within the SEPUP instructional material is linked to one or more of the five variables, and can be scored with the associated scoring guide.

The extended assessment system includes processes for teachers to moderate the scoring process and to track student progress throughout the year.

→ **Teacher-Based Materials Development**

SEPUP believes that the best instructional materials are those that utilize the expertise of educational professionals: teachers. In addition to having a development staff composed primarily of former classroom teachers, the SEPUP materials development process utilizes the input and expertise of teachers and students from around the country. SEPUP materials are developed by a process that involves extensive field testing and takes several years to complete. Materials are first prepared in draft form and tested in local classrooms by SEPUP developers or teachers working closely with

SEPUP developers. The materials are then revised and prepared for national field testing. National field tests typically involve 30 to 60 teachers and 2,000 to 6,000 students in urban, suburban, and rural school sites around the country. Teachers and students use the draft material and provide extensive written feedback to SEPUP. The materials are then revised and often undergo a second round of national field testing before final revision, external scientific review, and commercial publication.

7 SEPUP Instructional Materials: An Overview

At the heart of all SEPUP instructional materials are kits with laboratory equipment and printed support materials for students and teachers. Student books include directions for laboratory activities, investigations, specially selected reading material, and sample data tables; teacher's guides provide needed support including lesson plans, background materials, and solution preparation pages. Suggestions for integration across the curriculum are also included in many of the SEPUP instructional programs.

SEPUP Courses

SEPUP currently has three year-long courses available in various stages of production. For the most up-to-date information, contact SEPUP or visit our website.

Science and Sustainability (S&S)

Developed for use in the high school, *Science and Sustainability* explores issues relating to the need for today's society to provide for the future as well as the present. The instructional materials are based on rigorous scientific investigations of important concepts in biology, chemistry, physics, and earth science. In addition to investigating personal and local issues, students develop a global perspective by examining issues from the point of view of people in different regions of the world. The course is integrated by a thematic approach to issues and concepts and is organized into four units: Living on Earth, Food For a Growing World, Making Life More Productive, and Fueling the World.

Issues, Evidence and You (IEY)

Issues, Evidence and You, intended for use in grade 8 or 9, highlights concrete and experience-based issues that impact not only students' personal lives but also their local communities. The course is divided into four parts: water usage and safety;

materials science; energy; and environmental impact. Students explore concepts such as solutions, concentration, chemical interactions, risk assessment, and toxicity as they investigate these various issues.

Science and Life Issues (SALI)

Field-tested with seventh-graders, *Science and Life Issues* focuses on life sciences and their relationship to personal decision-making. Three thematic segments—My Body and Me, Living Partnerships, and Using Tools and Ideas—unify the course topics, which include the nature of science, the human body, cellular study, infectious disease, genetics, ecology, evolution, and using tools and ideas. The course also focuses on four process-oriented components: scientific thinking, personal and societal decision-making, science and technology as professions, and science as a predictive activity.

SEPUP Modular Materials

SEPUP has produced a series of 12 independent units, known as SEPUP modules, and an upper-elementary-level program, *Chemicals, Health, Environment, and Me* (CHEM-2), as modular materials that are intended to supplement science instruction.

SEPUP Modules

Each SEPUP module is a series of related activities designed as a 2–4-week unit for grades 7–12. The activities use inquiry-based problem-solving approaches to learning in which the importance of decision-making based on evidence is emphasized. The table at right provides a brief description of each module.

Chemicals, Health, Environment, and Me (CHEM-2)

CHEM-2 is a series of fifteen enrichment units designed to provide laboratory experiences for fourth- through sixth-grade students to help them understand the nature of chemicals and how they interact with the environment. Students collect, process, and analyze information, and learn how to use scientific evidence as a basis for decision-making. In addition students build an understanding of how studying science and mathematics can be a productive and relevant part of their lives. CHEM-2 units have been designed to focus on science and also include suggestions for integrating CHEM-2 into the upper elementary school curriculum. The fifteen units are: Everyday Chemicals, Build a Community, Sound, Energy to Go!, CHEM Chronicle, The Inside Story, My Sweet Tooth, Mystery Spill, Hazardous Home, Trash or Cash?, What Is a Threshold?, Smoking and My Health, Carbon Dioxide and Me, Pharmacology, and Good to the Last Drop.

Summary of SEPUP Modules

Module Title	Description
Chemicals in Foods: Additives	Students explore food preservation, examine food labels, investigate processing additives, and perform a simulated test for pesticide residues.
Chemical Survey & Solutions and Pollution	Students respond to a questionnaire concerning their perceptions about chemicals. They then apply principles of acid-base chemistry to deal with some of our water pollution problems.
Determining Threshold Limits	Experimentation introduces the concepts of qualitative and quantitative analysis. A simulated animal toxicity experiment introduces students to the need for, and limitations of, extrapolating data from animals to humans.
Household Chemicals	Students explore the hazard categories of household chemicals and discuss appropriate storage and disposal methods.
Investigating Chemical Processes: Your Island Factory	Chemical reactions are introduced as one important operation of many industries. Students imagine that they reside on an island and must use island resources to provide employment opportunities and products for the local economy.
Investigating Groundwater: The Fruitvale Story	This hands-on simulation illustrates how the source and the extent of a groundwater contamination plume are determined. Students take the roles of concerned professionals and community members and try to develop a clean-up strategy.
Investigating Hazardous Materials	Students are introduced to methods for physically separating, sampling, and identifying the contents of a barrel of simulated hazardous waste as they explore problems involved in hazardous waste disposal.
Plastics in Our Lives	Students explore the advantages and disadvantages of each choice as they learn about physical properties and environmental issues involved in the production, use, recyclability, and degradability of plastics.
Risk Comparison	Students are introduced to the concepts of probability, risk, risk comparison, and decision-making.
Toxic Waste: A Teaching Simulation	Students explore how precipitation, oxidation-reduction, and single replacement reactions can be used in waste reduction and waste treatment processes.
Understanding Environmental Health Risks	Students consider personal actions they might take in order to reduce their exposure to environmental health risks such as biological and chemical risks in the water supply, pesticide residues, and toxicity levels.
The Waste Hierarchy: Where Is "Away"?	Students examine the amount and categories of trash they personally discard and compare their findings with national norms. They then consider methods of disposal based upon the concept of a waste hierarchy.

8 SEPUP Materials and the National Science Education Standards

The goals of the United States National Science Education Standards emphasize the need for a scientifically literate society. The stated goals identify the scientifically literate person as one who knows about and understands the natural world, uses appropriate scientific processes and principles in making personal decisions, and is able to participate effectively as a citizen in personal and public policy decision-making on issues related to science and technology. Such decision-making is essential today and will become even more important in the twenty-first century as our search for effective approaches to the sustainability of our society intensifies.

Our experience developing SEPUP and the evidence provided by users of our materials clearly indicate that taking an issue-oriented approach helps to accomplish the goals of the National Science Education Standards (NSES). These goals are similar in intent to the SEPUP goals, which were first published in 1987 and are reproduced on page 4 of this guide. (A transparency comparing the SEPUP goals with the NSES goals can be found in the Appendix.)

The emphasis on scientific literacy in both the SEPUP goals and the National Science Education Standards provides the basis for the strong correlation between all SEPUP materials and the Standards. The quality of SEPUP materials has been recognized by the National Science Foundation and by the Eisenhower National Clearinghouse, among others.

9 SEPUP Materials and Curriculum Integration

Given the number of priorities within the school system, instructional materials that can accomplish more than one goal are more likely to gain widespread support and use. One advantage of issue-oriented science is that it is particularly appropriate for curriculum integration. Curriculum integration is seen as a way to make science relevant to the life of all students because it helps provide connections between subject areas. Particularly in the middle schools and high schools, it can provide opportunities to team with teachers in other subject areas or to simply reinforce student learning in other subjects. While there are many ways in which SEPUP materials may be integrated with other subjects, sharing knowledge of your science curriculum with other teachers is essential.

Sharing your science curriculum can be accomplished by conducting a SEPUP workshop for members of other departments or by displaying SEPUP materials in a common area, such as teacher's lounge. Consider discussing integration possibilities at staff meetings by providing other teachers with a copy of your syllabus and student materials. There is often an overlap in curriculum content between other subject areas and what is taught in SEPUP. Process skills in other subject areas can be supported through teaching SEPUP, particularly in mathematics and language arts. Brainstorming ideas with members of other departments helps to generate integration ideas that reflect the appropriate academic goals and objectives for each discipline.

SEPUP Materials and Literacy

You can also use curriculum integration to meet district-wide goals. One important goal in many school districts today is increasing student literacy. SEPUP materials are well-suited to helping support that goal, and a hands-on, issue-oriented approach to science can contribute to the accomplishment of many literacy goals.

SEPUP instructional materials address literacy issues by taking a constructivist approach to the learning of science. Through inquiry-based instruction students develop an understanding of new terminology before it is formally introduced. As students engage in hands-on activities, they begin to develop an operational understanding of a concept that is later defined. This encourages students to internalize and understand new terminology based upon their practical experience.

SEPUP's issue-oriented approach is based on a variety of instructional strategies that also can be linked to literacy standards. For example, under the New Performance Standards for English Language Arts (NPSELA) goals of speaking, listening, and viewing, it states that the student should "participate in one-to-one conferences with adults and in group meetings; prepare and deliver an individual presentation; [and] make informed judgments about television, radio, and film." Almost every SEPUP instructional program includes activities that require students to work together to share information, make presentations, and form judgements. This is the heart of the SEPUP philosophy of evidence-based decision-making in which students gather and share evidence, discuss trade-offs, and make decisions.

The fact that science instruction has goals remarkably similar to those of literacy is often overlooked. In SEPUP instructional materials, students are frequently assessed on their ability to design and conduct an investigation (one of the variables in the SEPUP Assessment System). One literacy goal of the NPSELA is the writing of a narrative procedure, in which students respond to four questions: "What was I

looking for? How did I look for it? What did I find? What does this mean?” This correlates significantly to the process of designing and conducting an investigation. After gaining experience with investigations, students using SEPUP materials begin to design and conduct their own investigations. The students are expected to produce a hypothesis describing the expected outcomes of the investigation; a written procedure clearly describing how they will carry out their investigation; an analysis of the data collected during the investigation; and a conclusion interpreting the results of the investigation. The SEPUP approach to designing and conducting investigations is similar to the expectations of a narrative procedure—a literacy goal. By identifying such similarities, science teachers can effectively support the goals of literacy while encouraging their students to accomplish science objectives.

SEPUP activities provide numerous opportunities for reinforcement of literacy skills. Each time students are asked to observe, compare and contrast, predict, sequence, or make inferences and draw conclusions, they are reinforcing and developing their literacy skills as well. Similarly, when students are asked to differentiate between evidence and inference and to use evidence to support their points of view, they are using the skills of literacy identified in literacy standards. It is clear that reading and writing are essential forms of communication in science, and thus provide students with opportunities to increase their literacy skills at the same time they increase their knowledge of science.

In addition, some SEPUP materials have specific components that address literacy in the classroom. CHEM-2 includes a “Tool Kit for Curriculum Integration” with specific teacher suggestions for language-based extensions. *Science and Sustainability* has a “Language Links” element in the teacher’s guide for each unit, offering suggestions for science teachers on how to connect literacy activities to their science teaching.

All teachers would agree that student literacy is an important goal. What many teachers may not realize, however, is that literacy is a goal that can be accomplished by instruction in a variety of subject areas, especially science.

SEPUP Workshops

10 Introduction

As a leader of SEPUP workshops, you will be working with many people who will be workshop participants for a variety of reasons. Regardless of the participants' similarities and differences, they will have one thing in common—they will have concerns about this innovation called SEPUP. Such concerns are a natural part of the change process which we all go through as we become involved in a new endeavor. The sections that follow provide guidance on getting workshop funding; working with adult learners; presenting a SEPUP workshop; and peer coaching.

11 Finding Industry Support

Without clearly defined strategies, teachers and other educational leaders are often unsuccessful at gaining industry support for programs in their schools. The following steps have proven successful in helping teachers get attention and support from industry: (1) identify a champion; (2) clearly define your needs; (3) use the champion to get through to industrial organizations; and (4) redefine your needs in terms of the goals of the organization.

To identify a champion, look for someone in industry who is willing to do more than say, "That's a good program. Hope someone supports it." A champion is someone who goes out of his or her way to do what it takes to make the program work. The person needs to have conviction to support the issues addressed by your program. Where would you look for this kind of person? Three similar job titles exist within many industrial organizations: Environmental Manager, Community Affairs Manager, and Local Affairs Manager. People in these positions often run into roadblocks when they talk to the public about legislation or regulations. They find that they are not able to communicate about science-related issues with the public. These managers are often willing to try to influence company policy in favor of a project which raises

public awareness. Another excellent source of “champions” are parents of your students who work for a company and know the value of the program you want to get funded for both their children and their company.

Secondly, define your goals and needs clearly. When asking for support, you need to be very specific. The organization you approach must see that its help is necessary to achieve your goals. Many industrial organizations are currently feeling the need for more scientifically trained employees. There seems to be significant support for science education and environmental efforts. Define for the organization specifically how the money will be spent and how much is needed.

Once you have identified your champion, have this person take your cause to the organization instead of doing this yourself. Local business associations have people who meet regularly to discuss issues of mutual concern. These groups are a good source for champions who will carry the group to a point of action. They can endorse your plan, giving it increased importance when it is presented to the specific industry. In small communities, the Chamber of Commerce often plays this role.

Another source for this kind of support is a foundation associated with a large organization. The foundation often exists for the sole purpose of giving a percentage of money to worthy causes. All you have to do is make sure you can compete with the other grant requests that come before the foundation. Often the foundation is a completely different group than the company itself, and often the contact can be made directly to the foundation.

Finally, express your needs in terms of the goals of the foundation or company. Sometimes an organization rejects a proposal because it does not seem to fit within its goals. Research the goals of your target organization and then show how your program meets its stated goals.

Once you have been successful in gaining the support of an organization, remember the professional courtesy of giving your industry sponsor feedback regarding what its support has achieved. This feedback is very important in maintaining ongoing relationships with your sponsors. If teachers use careful strategy while looking for industry support, great potential exists for industry-education partnerships.

12 Working With Adult Learners

Many of you may already be comfortable working in front of large groups. In many cases, those groups will have been composed primarily of students. When working with adult learners, some of the same methods may apply because you are basically sharing your knowledge with others. However, there are some important differences to remember when working with adult learners.

When working with adult learners it is important for you as the workshop leader to keep the focus of the workshop clear and on track. Do not allow the participants to lose focus by moving into an analytical discussion before they have had an opportunity to do the hands-on activity. You can accomplish this when you:

1. Begin by modeling classroom instruction as you introduce and conduct the SEPUP activities.
2. Follow up with a post-lab discussion in much the same way as you would in the classroom.
3. After engaging in the above, discuss and analyze the possible instructional methods that might be used in the classroom with this activity.
4. Finally, conduct a discussion with the workshop participants to help them analyze the rationale for the science concepts and societal issues and how they can more effectively accomplish their overall instructional goals for their students.

Focusing on Workshop Goals

As a workshop leader, your goal is to share your expertise and knowledge with the workshop participants. If the participants are adults, they may have very specific ideas about what should be accomplished with their time. Having identified your workshop as being about a particular subject, it is important to meet the expectations of the participants. For example, if you have titled your workshop “Using SEPUP in the Classroom,” spend the majority of your workshop time on how to use SEPUP in the classroom. While other topics may arise during the workshop, participants should leave feeling confident that the workshop was aligned with the stated goals.

Being an Effective Presenter

Think back to workshops that you have attended. What did you appreciate about a good presenter? What were some of the weaknesses of a poorer workshop? Use these reflections to guide you in deciding how to establish your own workshop style. Usually, a presenter who is excited about his or her topic is one who creates excitement for the participants.

When responding to participant questions, the enthusiastic presenter is responsive to questions or concerns. This means listening to participants and responding in an open, nondefensive manner. Adults often have strong opinions and may be accustomed to being correct. An enthusiastic and responsive presenter engages participants in a dialogue, not a debate.

Recognize that workshop participants may have a variety of concerns regarding the implementation of new instructional materials. In particular, teachers may be concerned about getting additional information on the programs, how the material will affect them personally, how to handle issues of classroom management, the effects of new materials on student learning, and the relationship between new instructional material and other local initiatives. In addition, teachers who are already experienced in the use of SEPUP materials may have ideas and suggestions to add to your presentation. Acknowledging participant concerns is an important part of working with adult learners; in some cases you may be able to offer a suggestion or answer to the concerns raised, and in other cases you may not. If you can understand where participants are with respect to change, it will be easier for you to respond appropriately. Try to listen beyond the words they speak. Being honest and helpful will make your interaction with other adults more rewarding.

Working With Adults Versus Children

If your experience has been primarily with children, be aware of some possible pitfalls when transitioning to working with adults. Adults may also be experts or have skills relevant to the workshop topic. Acknowledge that participants have experiences to contribute, and, when appropriate, provide opportunities for participants to share their expertise.

13 Presenting a SEPUP Workshop

There are two major kinds of workshops that presenters are likely to encounter: awareness workshops and training workshops. Awareness workshops are usually shorter (approximately an hour in length) and are intended to introduce the audience to SEPUP materials. Training workshops are typically longer (a half or full day) and are intended to train teachers in the use of a specific part or all of a SEPUP instructional program.

The major goals for an awareness workshop are to familiarize participants with the program generally and to enable them to make a decision regarding the potential usefulness of the materials in their programs. As a highlight of an awareness workshop, one hands-on SEPUP activity is done with the participants so that they can better understand some of the SEPUP strategies for more effectively teaching science. A brief account of the elements of SEPUP materials (see pages 7–11) and a time for participants to ask questions should also be scheduled. If you are presenting a large awareness workshop, you may want to contact SEPUP at least 7–10 days in advance for program literature that can be distributed to participants. If possible, bring a sample materials kit, teacher's guide, and printed student materials to display for participants unfamiliar with SEPUP instructional programs.

Training workshops will encompass a broader range of participants. In some cases, training workshops may be attended exclusively by teachers already familiar with SEPUP and its programs. In other cases, you may be training teachers both new to SEPUP and to the specific instructional program. Depending on your audience, modify workshop introductions and directions as necessary. Wherever possible, try to have at least two presenters for a training workshop. This will present opportunities to alternate the lead speaker, which provides variety for the audience and helps focus their attention. In addition, activity setup is more easily accomplished, as one speaker can prepare for the next activity (out of sight of the audience) while the other speaker is busy. It is strongly suggested that the presenters plan the presentation and their roles in some detail in advance.

Planning the Workshop

Almost all SEPUP workshops, whether for awareness or training, provide an opportunity for participants to do a SEPUP activity. Select an activity that illustrates the aspects of SEPUP that are the most important to your audience. Consider who will

be doing the activity (teachers, parents, administrators, etc.) as you decide. Choose an activity that illustrates the issue-oriented approach, utilizes 4-2-1, and models the use of the SEPUP tray and other materials. (See the table at right for suggested activities.) Estimate the amount of time needed for the activity and provide for more or less time according to the circumstances. If additional time is available, plan to present more than one activity.

All workshop participants should be provided with copies of the SEPUP student sheets you plan to use and an agenda, if appropriate. Providing teacher participants with two sets of student sheets allows them to have one copy on which to record their answers and teaching notes during the workshop, and another copy to use as unmarked masters for classroom use. Be prepared for additional attendance—have additional workshop materials and printed materials available.

Plan what you want to accomplish within the time allotted by preparing a workshop agenda. Consider the inclusion of times on the agenda carefully; publishing times can help the presenter keep to the schedule, but may also stifle otherwise profitable discussion or cause some concern among participants about keeping to the schedule. Depending on the length of the workshop, include mid-morning and mid-afternoon breaks in the schedule.

To accomplish the goals and objectives of the workshop session, you must effectively communicate information or teach skills, or both. Effective transition and closure statements help relate new learning to old, thereby facilitating transfer and assimilation of new content or skills. It is a common mistake to assume that participants can supply the “glue” that binds workshop ideas together—you are likely to have to supply much of this adhesive in the form of effective transition and closure statements. It is recommended that you examine the agenda critically in advance, identifying logical breaks and preparing helpful transition statements or activities. Closure statements summarize the main concepts or the steps in a skill or process, and help the participant clarify what has been presented and how it might be applied. Like transition activities or statements, it is recommended that you give some thought to the nature of these closure statements in advance.

Many people may be unfamiliar with essential components of SEPUP instructional materials. An introduction to the SEPUP approach and the instructional materials that are the focus of the workshop should be the basis for your workshop introduction. It is suggested that you emphasize the following points during your introduction. (You can use the transparency masters provided in the Appendix to provide visual organization.)

Suggested Activities Highlighting Unique Elements of SEPUP Instructional Materials

	SALI	IEY	S&S	CHEM-2	Modules
Issue-Oriented	38 Have They Croaked?	7 Chlorination: How Much Is Too Much?	10.3 Development Decisions 37.2 The Global Shuffle	Mystery Spill	Understanding Environmental Health Risks
4-2-1	14.1 A Perfect Match	47 Batteries: Energy and Disposal	5.1 Designing an Insulated System 24.1 Extracting Metal From a Rock	Good to the Last Drop	Solutions and Pollution
Trade-offs/ Decision-Making	20.2 Making Informed Choices	38 Which Packing for Mike's Games?	18.4 Cattle Calls 29 Understanding Today's Refrigerators	My Sweet Tooth	Plastics in Our Lives
Guided Inquiry	21.1 Inside a Pump 32 Gene Combo	50 Investigating Energy Transfer	1.2 Survival Needs 15.4 Building Blocks of Chemical Change	Everyday Chemicals	Investigating Groundwater: The Fruitvale Story
Assessment	37 Finding the Children: Blood Group Evidence 22.2 Round and Round	5 John Snow and the Continued Search for Evidence	32.4 Investigating the Decomposition of H ₂ O ₂	Energy to Go!	Investigating Chemical Processes: Your Island Factory

- Background on SEPUP as a nonprofit organization committed to providing instructional materials to improve student learning
- Importance of the classroom teacher in every phase of materials development
- Issue-oriented nature of SEPUP materials that allow students to make evidence-based decisions
- Guided inquiry approach
- Availability of the SEPUP assessment system
- Use of commonly available laboratory materials that can be used safely with students
- Non-advocacy nature of SEPUP materials
- Opportunities for integration across the curriculum using SEPUP
- Overview of the workshop goals (see “Conducting the Workshop”)
- Overview of instructional materials to be presented in the workshop (including a review of the format of units within the student pages as well as the major components of the teacher’s pages)

Planning for the Facility

Select the site and, if possible, visit it beforehand to examine it and to make all necessary arrangements. Before the workshop, verify that the facility has been reserved and determine if there are any special time limits about its use. Find out if you will be able to get into the room early to set up.

Be sure to note the seating arrangements within the room. Tables are necessary for all workshops that incorporate hands-on activities, and tables which seat four participants are preferred. Other groupings can be used, but remember that the materials have been designed to be used in groups of four. In addition, keep in mind that beverages and snacks should be kept in an area separate from the SEPUP materials.

A chalkboard (or whiteboard) will allow you to model the classroom setting. An overhead projector can also be used to record participant responses and to display transparencies (blackline masters are provided in the Appendix).

Arrange to have access to water. SEPUP can be and is being used successfully in classrooms that do not have running water. This can be demonstrated at the workshop by having one or two rubber, plastic, or metal tubs (such as might be used for washing dishes) handy for participants to clean and rinse equipment. Pitchers of water can be used to refill the tubs or to rinse materials. If you are providing the water, be sure to have some paper towels available for spills and clean-up.

Have all equipment in working order, but provide extras “just in case.”

Conducting the Workshop

Getting Started

Depending on the time available, you may wish to have workshop participants briefly identify themselves and state their objectives in attending the workshop (e.g. “I’m here because my science background is not strong and I’d like to improve it,” or “I’m here to pick up some ideas about chemicals and the environment to use with kids”). Such statements of objectives can be very helpful to the presenter in tailoring the workshop to the needs of the participants. Be sure to limit the amount of time per participant in order to leave adequate time for meeting the workshop goals.

Begin by providing an overview of the workshop agenda. The overview provides a “road map” that provides a sense of timing and helps participants anticipate key outcomes. It serves to focus the attention of the participants and provides a higher level of motivation. Essential components of the workshop include the rationale for the session (stating workshop goals and expectations) and a description of the desired level of participation of the audience. Making sure that those attending the workshop know what is expected of them will help the workshop run more smoothly.

If your audience is not familiar with SEPUP, introduce them to the SEPUP approach and the instructional materials that are the focus of the workshop (see the list on page 24). Use transparencies to highlight your presentation.

Do not spend more than 10–15 minutes at the beginning of the workshop introducing ideas. If the time required to get started begins to exceed 15 minutes, go directly into a hands-on activity. Then point out key elements of the SEPUP approach throughout the workshop, as they arise.

The SEPUP staff would like to include the names of workshop participants on our mailing list, so that we can send them copies of our quarterly newsletter and other announcements or information of interest. If appropriate, pass around the SEPUP Sign-up Sheet (see Appendix) for participants to provide their contact information.

During the Workshop

Provide a rationale for a task before providing instructions. Tell participants why the task is important or how it relates to other activities. Specify parts of the task and special conditions that might apply (time to accomplish, group or individual activity, etc.). Suggest instead of command—say “Let’s take about ten minutes for this,” instead of “Do this in ten minutes.” Notify the group when allotted time is coming to a close, rather than abruptly switching from one activity to another. Avoid instructions that are overly redundant or condescending. Clear, concise instructions let participants know what is expected of them. In general, a set of good instructions has at least three components: (1) an overview of the process or outcome desired (“We will now filter the mixture”); (2) a step-by-step account of what is desired (“You should first prepare the filter funnel, insert it into the filter holder, wet it slightly with water, and add the mixture slowly until no more liquid passes through the bottom of the cone”); and (3) a check for understanding and comprehension of the audience (“Is this clear? Do you understand?”). Note that specific questions related to an activity should be handled either as they arise or at the conclusion of the activity.

Effective transitions provide a level of continuity between activities so that essential learning is reinforced. It is useful to provide a short summary at the end of each activity, including time to share the concepts discussed and the application of ideas developed. Small groups provide an excellent format for this kind of discussion to take place. Overall themes must be emphasized, and effective transition statements can be used to provide closure to the previous activity while alerting participants to new learning in the next activity. A summary statement or two should generally precede the overview of the next activity. Plan a brief period for general questions at the end of each section.

The group discussion is a vital part of a workshop, whether the discussion is a short one, with specific outcomes, or a longer one, in which various points of view are contrasted and compared. You can increase the involvement and interaction among participants by using strategies that promote group interaction and involvement—accepting, encouraging, and supporting—and by using strategies that contribute to the completeness and relevance of the subject—extending, clarifying, paraphrasing,

focusing, and providing sufficient “wait time” before responding. Attempt to involve as many participants as possible, but do not insist on responses from everyone. It is often useful to direct small groups to discuss an issue for a short period of time. Volunteers from each group can then briefly summarize the answers or ideas of their group with the entire audience. In this way the participation of individuals reticent about speaking up in a large group can be maximized.

Use directed, or convergent, questions when the purpose is to check recall and comprehension. Use open-ended, or divergent, questions when the purpose is to get participants to think analytically, to discuss advantages and disadvantages, or to discuss the applications of what has been learned. Using the wrong type of question, such as an open-ended type question when a directed response is desired, often results in a “fishing expedition” where the presenter is forced to respond to each incorrect answer with language similar to this: “That’s a good answer, but not the one I was thinking of.” Consider the size of the group and provide a balance of each type of question. For example, it is generally not very useful to hold a long discussion with many open-ended questions in a short awareness workshop.

The manner in which the presenter responds to questions should be positive and indicate respect for participants. Avoid “put-downs” or responses that indicate arrogance or superiority of knowledge. Be especially mindful of nonverbal mannerisms. Allow adequate time for final summary and discussion, where application of what has been learned is discussed. Be alert for discussion opportunities as they arise—for example, several participants may remark on a similar classroom experience that reinforces a key point. Reinforce main points with examples from your own experience when possible, but do not let your own experience become the dominant perspective. Presenters are obviously expected to become involved in the discussion but should remember that they are discussion leaders.

Providing Closure

In general, a conceptual understanding of new content or skills helps establish a framework for more detailed analysis. This is why most participants place primary emphasis on the “what” and the “how to” at workshop sessions before the “why” is discussed. Despite the time constraints of a workshop, time must be provided for participants to reflect on and discuss what they’ve learned. Although questions tend to be answered as they arise during the workshop, it is always a good idea to schedule

a few minutes at the close of the workshop for any questions participants may have. These questions are likely to be of a general nature, not specific activity-related questions.

Provide an address or phone number at which you can be reached for further information. If you wish, you can post SEPUP's contact information, which is printed in the front cover of this guide. Please note that instructional materials cannot be purchased through SEPUP; SEPUP is a nonprofit organization devoted to instructional materials development and teacher development projects. Instructional materials can be purchased either through Lab-Aids® (1-516-737-1286) or Sargent-Welch (1-800-727-4368).

Evaluating the Workshop

You generally have two main sources of information available for evaluating a workshop session. You may use feedback from the audience while the workshop is still in session to evaluate the effectiveness of the workshop. This feedback may be verbal or nonverbal. As the interpretation of nonverbal information is often difficult, verbal information should be elicited whenever necessary. You may wish to monitor the comments or conversations of the participants as needed, especially when an opportunity arises, such as when participants are engaged in an activity. Also elicit specific audience feedback at regularly scheduled times—for example, at transition or closure points. This kind of feedback will help you know whether the participants feel the workshop materials and pacing are appropriate, or whether a deviation from the agenda should be considered.

The second kind of feedback occurs when the workshop is concluded. This feedback is typically provided by the participants in the form of a written evaluation. Several evaluation forms, including self-evaluation forms, are included in the Appendix. You may wish to use one of these, or to modify or adapt one for a specific purpose. Participants should understand that the feedback is valued and desired, and sufficient time should be allotted in the workshop agenda for the forms to be completed at the workshop site.

14 Peer Coaching

When you are not involved in formal workshops, try to maintain continued contact with the teachers you have trained. One effective way to do this is by using peer coaching strategies. Your school can become a professional learning environment in which all teachers learn and grow together. Peer coaching is a way to maintain ongoing teacher development, using each other as resources and agents for growth. It can be a powerful alliance among professionals to achieve best practices and to become more effective teachers of science.

Try the following ideas to help you become more effective as a peer coach when working with your colleagues:

- Share information freely about the SEPUP project as it relates to school and district goals
- Invite teachers to observe you teaching a lesson and then discuss it
- Offer support through empathetic listening and by sharing experiences
- Assist the teachers in arranging and analyzing the physical setting of the room to maximize learning
- Promote self-observation, reflection, and analysis
- Counsel your teachers when difficulty arises
- Link teachers to resources
- Model a professional attitude that includes collegiality with peers and continuing professional development

Peer coaching assumes a collegial relationship between participating parties resulting in a relationship that is mutually beneficial. One important way to help accomplish this is to observe each other teaching science classes, so that observing and critiquing can be a shared experience from which you both learn and grow. Being able to listen intently to the concerns of the teachers is a very important skill to develop as a peer coach. This will help teachers understand that you will work with them collaboratively and nonjudgmentally so that they can begin to assess their own progress openly and nondefensively. Use active listening by paraphrasing what is said so that you demonstrate that you want to hear what the person has to say, can understand the importance of what has been said, and can genuinely accept the other

person's ideas no matter how different they are from your own. The following questions are designed to encourage dialogue after you have observed your colleague teaching a science lesson.

1. What do you recall about the students' responses to the lesson?
2. How did the students' responses compare to what you thought they would be?
3. What strategies did you use that you think worked well? Did not work well?
4. To what extent do you think the objectives of the lesson were achieved?
5. If you were to do it again, what would you do the same and what would you do differently?

15 In the Final Analysis . . .

Finally, as a SEPUP workshop leader in your school district, you may wonder how you can best find evidence of the effectiveness of your workshops. The greatest impact of your work will probably be reflected in the classroom through the teachers with whom you have had an ongoing working relationship. It is here that you will gather insight into just how effective the SEPUP workshop strategies you used have been translated into the real world of the classroom. The "Observation Checklist for Inquiry-Based Science" (included in the Appendix) will help focus your observations. You can use it as a guide to help you understand what areas your colleagues have internalized and what areas still need work to further develop effective science instruction. You may also want to offer it to school administrators observing science lessons to help guide their observations, especially if they do not have the experience or expertise to evaluate inquiry-based science instruction.