Science Education for Public Understanding Program (SEPUP)

- Based at the Lawrence Hall of Science, University of California, Berkeley
- Funded by the National Science Foundation (NSF) since 1988
- Published and distributed by LAB-AIDS, Inc.
Workshop Goals

Participants Will...

• Understand the SEPUP Approach through a series of investigations from *Force and Motion*.

• Utilize the SEPUP Assessment System

• Recognize Literacy Strategies

• Become familiar with the components of the SEPUP curriculum
Workshop Goals

Participants Will...

• Understand the SEPUP Approach through a series of investigations from Genetics

• Utilize the SEPUP Assessment System

• Recognize Literacy Strategies

• Become familiar with the components of the SEPUP curriculum
The SEPUP Approach to Teaching and Learning

- Personal and societal issues to introduce science
- The role of scientific evidence and trade-offs in decision making
- Different approaches to hands-on inquiry
- Age-appropriate teaching strategies
- Spiraling of key concepts and skills over time
The SEPUP Approach to Teaching and Learning

- Assessments that are embedded in the curriculum
- The 4-2-1 approach to cooperative learning
- Curriculum designed using the best of research and practice
- Explicit connections to other disciplines, such as literacy, mathematics, and technology
What is Issue-Oriented Science?

- How can a motor vehicle be made safer?
- How can a family reduce their energy costs?
- What is the environmental impact of the life cycle of your computer?
What is Issue-Oriented Science?

- *How do you decide what type (s) of medication, if any, to take when you are ill?*

- *How might you accidentally introduce a new species into a local ecosystem?*

- *What can you do to reduce the risk of catching an infectious disease?*
SEPUP Learning Cycle

COLLECT SCIENTIFIC EVIDENCE
Gather scientific evidence through inquiry activities and readings.

MOTIVATE
Create a context with an issue or problem.

CHALLENGE
Focus on a specific question. What do we need to know?

ANALYZE THE EVIDENCE
Interpret and/or evaluate the nature of scientific evidence.

BUILD KNOWLEDGE AND MAKE CONNECTIONS
Build conceptual understanding of important scientific ideas. Connect new learning to previous ideas.

USE EVIDENCE
Apply the evidence to address the original issue or problem.
Issues and Life Science

- Experimental Design: Studying People Scientifically
- Body Works
- Cell Biology & Disease
- Genetics
- Ecology
- Evolution
- Bioengineering
Critters Breed 1

Skye

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Poppy
Activity 65 – Breeding Critters

1. Model the diversity of offspring possible from two parents.

2. Discover patterns of inheritance other than strict dominant/recessive traits.

*Synthesizing concepts & vocabulary*

**Content vocabulary in this activity:**

- Allele
- Dominant

- Characteristic
- Gene

- Chromosome
- Recessive

- Diversity
- Trait
Breeding Critters

**CHALLENGE:** What are some patterns of inheritance other than the ones discovered by Mendel?

**ASSESSMENT** – Understanding Concepts (UC)

**PROCEDURE** – Generation Three Offspring
Given two pure breed grandparents, who produce all heterozygous offspring, what traits will appear in the third generation?

Model includes simulation of:
- *Co-Dominance*
- *Incomplete Dominance*
- *Environmental Effects on Inherited Traits*
- *Sex Determination*
## Scoring Guide: Understanding Concepts (UC)

### What to Look For

Response identifies and describes scientific concepts to a particular problem or issue.

| Level 4 | Student accomplishes Level 3 AND goes beyond in significant way, such as  
|         | • using relevant information not provided in class to elaborate on your response.  
|         | • using a diagram to clarify scientific concepts.  
|         | • relating your response to other science concepts.  

<table>
<thead>
<tr>
<th>Level 3</th>
<th>Student accurately and completely explains or uses relevant scientific concepts.</th>
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<table>
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<tr>
<th>Level 2</th>
<th>Student explains or uses scientific concepts BUT has some omissions or errors.</th>
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<table>
<thead>
<tr>
<th>Level 1</th>
<th>Student incorrectly explains or uses scientific concepts.</th>
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<table>
<thead>
<tr>
<th>Level 1</th>
<th>Student’s response is missing, illegible, or irrelevant.</th>
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| X | Student had no opportunity to respond. |
The SEPUP Assessment System has been cited in numerous journal articles and publications, as an exemplary approach to assessing student learning.

*Knowing what Students Know*

*Classroom Assessment and the National Science Education Standards*

(National Research Council, 2001)
COMPONENTS OF THE SEPUP ASSESSMENT SYSTEM

VARIABLES (skills to be assessed)
- Designing Investigations (DI)
- Organizing Data (OD)
- Analyzing Data (AD)
- Understanding Concepts (UC)
- Recognizing Evidence (RE)
- Evidence and Trade-Offs (ET)
- Communication Skills (CS)
- Organizing Scientific Ideas (SI)
- Group Interaction (GI)

SCORING GUIDES (rubrics)
- describing
- 4 competency levels for each variable

ASSESSMENT QUESTIONS
- for each variable

ASSISTANCE FOR TEACHERS

BLUEPRINTS/OVERVIEWS
- showing where assessment tasks are found throughout course or module

EXEMPLARY
- of student work for each competency level in the Scoring Guide

MIFICATION
- collaboration with other teachers for setting criteria in scoring

ITEM BANKS
- for tests and quizzes

QUICK CHECKS
- for informal assessment
<table>
<thead>
<tr>
<th>Literacy Category</th>
<th>Literacy Strategy</th>
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<tbody>
<tr>
<td>Supporting Reading Comprehension</td>
<td>- Anticipation Guide</td>
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<tr>
<td></td>
<td>- Directed Activities Related to Text (DART)</td>
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<td></td>
<td>- Listen, Stop, Write</td>
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<td></td>
<td>- Reading Scientific Procedures</td>
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<td></td>
<td>- Three-Level Reading Guide</td>
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<tr>
<td>Enhancing Student Writing</td>
<td>- Keeping a Science Notebook</td>
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<td>- Writing a Formal Investigation Report</td>
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<td>- Writing Frame Writing Review</td>
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<td>- Research Project</td>
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<td></td>
<td>- Assessment: Communicating Scientific Information</td>
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<tr>
<td>Facilitating Group Discussion</td>
<td>- Discussion Web</td>
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<td>- Intra-act</td>
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<td>- Oral Presentation</td>
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<td>- Walking Debate</td>
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<td>- Assessment: Group Interaction</td>
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<tr>
<td>Synthesizing Concepts and Vocabulary</td>
<td>- Categorization Activity</td>
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<tr>
<td></td>
<td>- Concept Map</td>
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<td>- KWL</td>
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<td>- Talking Drawing</td>
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<td>- Venn Diagram</td>
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## Strategies for Diverse Learners

<table>
<thead>
<tr>
<th>Strategy</th>
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<tbody>
<tr>
<td><strong>Students with Learning Disabilities</strong></td>
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<tr>
<td>• Hands-on activities provide concrete experiences.</td>
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<tr>
<td>• Optional student sheets provide step-by-step procedures for open-inquiry labs.</td>
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<tr>
<td>• Literacy strategies support improvement of reading comprehension and writing skills.</td>
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<tr>
<td>• Discussion strategies facilitate communication.</td>
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<tr>
<td>• Scoring guides state clear assessment goals.</td>
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<tr>
<td><strong>English-language Learners</strong></td>
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<tr>
<td>• Vocabulary is introduced with operational definitions that connect concepts to learning experiences.</td>
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<tr>
<td>• 4-2-1 cooperative groupings encourage student interactions in an unthreatening environment.</td>
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<tr>
<td>• Discussion strategies enhance speaking and listening skills.</td>
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<tr>
<td>• Literacy strategies strengthen reading and writing skills.</td>
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<tr>
<td><strong>Academically Gifted Students</strong></td>
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<tr>
<td>• Issues stimulate evaluation of problems in real-world contexts.</td>
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<td>• Lab activities encourage students to design complex investigations.</td>
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<td>• Scoring guides challenge students to demonstrate their depth of understanding.</td>
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<tr>
<td>• Extension activities encourage in-depth inquiry into related topics.</td>
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