PUBLISHER'S BACKGROUND

Lab-Aids is the exclusive publisher and producer of kit materials and equipment for the *Issues and Science* middle school science program, developed by SEPUP. Lab-Aids and SEPUP partner very closely on SEPUP development, from the design of new kit item prototypes, to production work on digital ancillaries such as lesson PowerPoints, video treatments and digital simulations for absent students, and to provide professional development to thousands of science teachers annually. Since 1963, our core belief has been that students learn best by direct, hands-on experiences. This can be found across our many kits and curricula.

The Science Education for Public Understanding Program (SEPUP) is a science and engineering education project developed by former and current classroom science teachers and educational researchers. Located at the Lawrence Hall of Science, the public science center of the University of California, Berkeley, SEPUP has over 30 years of experience designing innovative instructional materials to support the implementation of reform-based science and engineering education. SEPUP programs have been funded, in part, by the National Science Foundation.

The SEPUP approach features the use of personal, societal, and environmental issues to engage students in the study of science. Using SEPUP, students consider such issues as the environmental impact of improper computer disposal, the health effects of high energy sound and light waves on the human body, and the impact of introduced species on local ecosystems. The use of issues is supported by a large body of research over the years, and more recently by *A Framework for K-12 Science Education*, which suggests that science should "...relate to the interests and life experience of students or be connected to societal or personal concerns that require scientific or technical knowledge." (NGSS Lead States, 2013, p. 31).

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The SEPUP middle school program has been refined through field tests and classroom use with diverse learners in urban, rural, and suburban schools. SEPUP analyzes feedback to inform iterations of the instructional materials, ensuring that they are engaging, effective, and appropriate for implementation in a variety of settings. *Issues and Science: Redesigned for the NGSS* builds on this analysis with current educational research and the reforms called for in the *Next Generation Science Standards* (NGSS) (NGSS Lead States, 2013).

The complete *Issues and Science* program consists of 17 units, each with its own Learning Pathways, which demonstrate the progressions toward the Performance Expectations in the unit. By the time students reach the activity incorporating the PE assessment at the end of a pathway, they will have interacted with the relevant 3-D elements numerous times in their learning journey. The complete program includes a print or digital Student Book and Teacher's Guide for each unit, a Teacher's Resource for the compiled units, highly organized equipment kits, and online digital ancillaries for teachers and students.

Over the years, impact studies have demonstrated the positive impact of SEPUP use with students (www.lab-aids.com/evidence-impact). SEPUP staff have presented papers on aspects of SEPUP development at national science education meetings, including the National Association for Research in Science Teaching (NARST) (2016, 2017, 2018) (sepuplhs.org/news.html). Additionally, the SEPUP assessment system has been featured in such national publications as *Classroom Assessment and the National Science Education Standards* (National Research Council, 2001) and *Knowing What Students Know* (National Research Council, 2001). More recently, SEPUP has taken the lead on an ongoing effort to develop program-agnostic middle level NGSS assessments, with support from the Carnegie Corporation of New York (sepuplhs.org/news.html).

Issues and Science | *Redesigned for theNGSS*

Designed for Three-Dimensional Learning

The instructional materials for *Issues and Science* were thoroughly redesigned to support teachers and learners in the implementation of the innovations called for in the NGSS. Opportunities for sensemaking at key moments in each SEPUP unit also support three-dimensional learning, as students use multiple dimensions to explore a phenomenon or solve a problem.

Examples of Three-Dimensional Learning Design in selected *Issues and Science* units

- Students *analyze and interpret data* (SEP) about *behavioral and other traits in animals at first glance seem to be neutral, or perhaps even harmful* (DCI). By *looking for patterns* (CCC) in the data, students develop arguments about the *cause-and-effect relationship* (CCC) between these traits and reproductive success (Reproduction).

- Students *develop and use a model* (SEP) to describe the *cycling of Earth's materials, and the flow of energy that drives this process* (DCI). Students examine the *geological processes that change the geosphere over varying time and spatial scales* (DCI) to explain the *stability and change* (CCC) of the natural system (Geological Processes).

- *Students plan and carry out an investigation* (SEP) on the effect of a cart's mass on its kinetic energy. *They identify patterns* (CCC) in the data they collect during their investigation, and then *analyze and interpret the data* (SEP) to describe the *relationship between the kinetic energy of an object and the mass of the object: the greater the mass, the greater the kinetic energy* (DCI) (Force and Motion).

- *Students develop and use models* (SEP) and *analyze and interpret data* (SEP) while designing a model heart valve. They *develop possible solutions and then evaluate their prototypes based on the criteria and constraints of the design before combining the best aspects of the prototype to optimize the design* (DCI). They *investigate the Influence of Science, Engineering, and Technology on Society and the Natural World* (CCC) when they consider the implementation of two different kinds of heart valves used currently on patients.

Issues and Phenomena

Each unit is centered on an issue that provides context for the relevant and connected anchoring phenomenon for the unit. Because the anchoring phenomena are broad and the related issues are complex, each unit is divided into instructional sequences that typically comprise two to five activities. In each of those sequences, students explore an investigative phenomenon, guided by a student-friendly driving question. The SEPUP storyline, a coherent conceptual storyline for each unit, describes the unit's logical progression and connects the instructional sequences. By the last activity in an instructional sequence, students are prepared to answer the driving question and explain the corresponding investigative phenomenon.

After completing each of the instructional sequences in a unit, students are able to explain the anchoring phenomenon for the entire unit and apply their conceptual understanding to offer solutions to the unit issue. For example, in *Land, Water, and Human Interactions*, students develop a plan for building a new school on an appropriate site, and identify the many ways that humans can engineer solutions to mitigate their negative impact on land and water when building new construction.

Support for differentiated instruction and literacy

In *Issues and Science*, classroom support for differentiated instruction is embedded into the program as a whole, with additional support in each activity, and identified in Strategies for Teaching Diverse Learners in the Teacher Resources. These modifications take different forms, depending on the goals of the activity, and include comprehensive support for students with learning disabilities, English-language Learners, and Academically Gifted Learners. SEPUP embeds support strategies throughout the units to help students access and process new content, develop analytical skills, connect concepts, become more proficient readers, and better express their thinking orally and in writing. Students are able to further build their knowledge and appreciation of science while simultaneously improving their reading and communication skills.

Assessment support

The SEPUP Assessment System is based on the idea that students benefit from regular opportunities to demonstrate learning through performance in the *context of their work at hand:*

- a group redesigning a structure to prevent erosion may *also* be evaluated on their understanding of engineering design
- feedback can be provided to strengthen a student's argument *as* she considers additional evidence about fossilized footprints and explains the patterns

Each unit includes a variety of assessments embedded within the instructional context to provide consistent, actionable information to the teacher, and students, with minimal impact on instructional time.

At the core of the SEPUP assessment system are **nine variables**. Assessment items and tasks are used to gather evidence of students' learning within each variable, while Scoring Guides and Exemplars are provided for interpreting their responses.

These nine variables are used throughout *Issues and Science* so that students may demonstrate a deeper understanding and level of sophistication, not only as one unit progresses, but as they move from unit to unit across grade levels. These assessment tasks, partnered with **quick checks, 3D formative assessment opportunities**, and unit tools such as unit **overviews, assessment blueprints, learning pathways,** and **item banks**, form the SEPUP assessment system.

The system is based on one developed earlier by SEPUP and the Berkeley Evaluation and Assessment Research (BEAR) Group at the University of California, Berkeley, Graduate School of Education. Studies show that students using SEPUP in classrooms using the system scored better in post-assessments than those in SEPUP classrooms who did not. The system has been widely used and redesigned extensively for use with the current *Issues and Science* program.

Learn more about *Issues and Science*
at lab-aids.com/edreports

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