SUMMARY OF RESEARCH FINDINGS ABOUT SEPUP, June 2004

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Extensive research has shown that the SEPUP program has significant positive effects on student learning. SEPUP students are able to gain content knowledge and develop problem-solving, decision-making, and investigation skills. Furthermore, SEPUP's approach to learning fosters student interest in science, which has resulted in higher enrollment in advanced science courses for some districts. SEPUP materials can also be a powerful professional development tool because they provide extensive support for good teaching practices.

Over the last fifteen years, various researchers and organizations have conducted studies on SEPUP, using both qualitative and quantitative analysis. Here are a few examples of their findings:

- As part of a 3-year research project at the University of Arizona, Stanley Pogrow (1993) reviewed and ranked middle school materials to identify those that were the most "creative, relevant, and rigorous." SEPUP materials were cited as exemplary and fulfilled his criteria that curriculum: 1) relate science content to issues of concern to students; 2) support a reflective, Socratic approach; 3) develop thinking skills; and 4) present content in a rigorous fashion.

- In his book *Redesigning Education*, Kenneth G. Wilson (1994) calls SEPUP "…one of the best American examples of educational design" (p. 205). Wilson, a Nobel-prize winner in physics and the former director of Project Discovery (a 5-year federally funded project to restructure K–12 mathematics and science in Ohio), has written extensively on school reform, noting that "…the [SEPUP] program develops its [materials] through a small scale version of the redesign process, from tracking basic research in education and testing prototypes in real classrooms to integrating innovations and mentoring teachers…" (p. 205).

- The National Science Foundation (NSF) Division of Elementary, Secondary, and Informal Education used more than 40 specific criteria to review NSF-funded middle level materials. In addition to questions relating to content, the reviewers asked whether the materials "push teachers to teach differently" and "provide students the opportunity to make conjectures, gather evidence, and develop arguments to support, reject, and revise their explanations for natural phenomena" (Lewis, 1996). The examining committee recommended both SEPUP modular and full-year comprehensive programs as materials that meet these criteria, noting that "the materials are engaging, provide good activities for student decision-making and opportunities for student-designed inquiry." (NSF, 1997).

- SEPUP instructional materials utilize a research-based assessment system that was developed in cooperation with the University of California Graduate School of Education. This system is recognized as "an excellent assessment component" of SEPUP materials in the NSF study cited above (NSF, 1997). In *Classroom Assessment and the National Science Education Standards* (National Research Council, 2001), the SEPUP assessment system is presented as a strong example of a system that can be used for both formative and summative assessment. Materials included in a SEPUP Teacher's Guide, such as scoring guides (or rubrics), are reproduced in the book for general use.

Students using the SEPUP curriculum show significant gains.

Research has found that students in classrooms using SEPUP showed significant improvements that reflected the goals and objectives of the SEPUP materials (Kelly, 1991). For example, students said SEPUP materials helped them learn about environment, health, industry, the community, and science—all of which are investigated in SEPUP's issue-oriented approach to science instruction. After using SEPUP, students were more likely to say that people should not make decisions until all the evidence has been collected and that today's scientific knowledge will change in the future. Among other things, these students also demonstrated increased content knowledge of topics covered by the SEPUP materials, including solution chemistry, acid-base interactions, and risk comparison (Kelly, 1991, Koker 1992b).

Besides helping students learn science effectively, SEPUP materials also promote a greater interest in science, which can lead to more students pursuing advanced science courses. For example, in 1995, the Los Angeles Unified School District (LAUSD) started implementing a two-year high school sequence of Integrated/Coordinated Science (ICS) classes substantially based on SEPUP materials. Besides significant gains in student performance, LAUSD schools reported higher numbers of students, and in particular underrepresented minority students, enrolling in advanced science courses (Scott, 2000). In addition, these ICS students showed significant gains on the SAT 9 (Stanford Achievement Test) science test (Scott, 2000).

How does SEPUP compare to non-SEPUP programs?

Several studies have compared SEPUP students to non-SEPUP students. One study that investigated SEPUP's *Issues, Evidence and You* curriculum found that while both SEPUP and non-SEPUP students showed educational gains after one year, only SEPUP students were found to make statistically significant improvements (Wilson et al, 1995). In another study, SEPUP students showed significant gains in content knowledge after only a few weeks of instruction (Koker, Thier 1994). Similar improvements were not found after such limited instruction among students using other science programs (Bredderman 1982,1983).

In addition to showing greater gains in content knowledge, several studies suggest that SEPUP students also improve more than comparable non-SEPUP students in a variety of specific skills. For example, Koker (1996) examined students' decision-making skills and found differences in student responses that generally favored SEPUP students over non-SEPUP students. He also found that SEPUP students were more likely to approach problems with empirical methods (e.g., doing tests, gathering evidence) rather than non-empirical ones (e.g., using "conventional wisdom" or rhetoric). Furthermore, Samson and Wilson (1996) found that compared to non-SEPUP students, SEPUP students not only performed better in problem-solving situations that called for scientific evidence but they also believed that science was more relevant to their lives. These SEPUP approaches can help students in future scientific as well as non-scientific contexts.

The SEPUP assessment system is central to improving student performance. This system provides credible evidence about student learning in key process areas such as the ability to design an experiment, interpret data, explain a scientific concept, or use scientific evidence to make a decision (Wilson & Sloane, 2000). Research has shown that gains for students using the assessment system were 3.46 times greater than those for non-SEPUP groups and a SEPUP group not using the SEPUP assessment system (Wilson & Sloane, 2000).

SEPUP has a positive effect on teachers, too.

Teachers who use SEPUP materials often show an increase in good teaching strategies and professional leadership (Kelly 1991, Koker 1992a, 1992b). This includes cooperating with other teachers, working with college science and science education faculty, participating in professional organizations, such as the National Science Teachers Association, and collaborating with outside groups related to industry, environmental, or community concerns. SEPUP instructional materials, assessment rubrics, and moderation activities are powerful professional development tools. Several studies have found that they improve teachers' ability to assess learning as well as improve their own teaching practices such as clarifying learning goals and establishing fair standards (Roberts, Sloane, & Wilson, 1996; Roberts & Wilson, 1998).

Based on this type of evidence, some institutions have used SEPUP materials as the basis for professional development workshops for teachers. In 2001, the University of North Carolina, Chapel Hill used activities adapted from SEPUP to create a professional development program. Environmental Resource Program educator Michele Kloda, who developed and led the workshop, commented, "Our goal was to help teachers give students real-life, meaningful experiences to show them that there are things we can all do every day to help maintain a healthy environment. It is an opportunity to help teachers, and ultimately students, understand that the work taking place [in research labs] has a direct application to our lives."

SEPUP continues to research and evaluate its materials.

Current efforts to assess student learning are focused on SEPUP's life science course for middle school, *Science and Life Issues (SALI)* which was published in 2001. The course has been adopted in Arkansas, Kentucky, Louisiana, Oklahoma, South Carolina, and West Virginia. In addition to the SEPUP embedded assessment system, SALI contains multiple choice and short answer questions correlated to the course and to the National Science Education (NSE) content standards for middle level life science. Results from the 2003–2004 school year are currently being scored and analyzed. In addition, several school districts, most notably Charleston, SC, are conducting their own studies on the effectiveness of SALI. They will be looking at students' progress on state exams and other tests such as the PASS test developed by WestEd.

For more information on SEPUP, visit the SEPUP website at www.sepuplhs.org

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