

Bibliography of SEPUP-Related Research

The following are references to research publications, presentations and papers about SEPUP, the Science Education for Public Understanding Program at the Lawrence Hall of Science, University of California, Berkeley.

Aikenhead, G. (2002) The educo-politics of curriculum development. *Canadian Journal of Science, Math and Technology Education*.

This paper describes some of the education politics related to developing issue-oriented curriculum such as SEPUP's *Science and Sustainability* and *Issues, Evidence, and You*. It suggests that more influence on the development of science curriculum should come from "societal experts," who are knowledgeable about the public's interaction with science- and technology-related problems, rather than academic scientists.

Atkin, J.M., Black, P., & Coffey, J. (Eds.) (2001). *Classroom Assessment and the National Science Education Standards*. Center for Education, National Research Council.

This book discusses how to align classroom assessment with the national standards. As an alternative to the traditional single-letter grade system, it recommends SEPUP's assessment system which can be used both for formative or summative assessments.

Binding, M., and Nagle, B. (2018). *Modeling Energy Flow and Matter Cycling: How the Curricular Approach Influences Students Development of Models*. Presented at the annual meeting of the National Association for Research in Science Teaching, Atlanta, GA.

This paper discusses how a middle school ecology unit, Disruptions in Ecosystems: Ecosystem Interactions, Energy, and Dynamics, developed by SEPUP, incorporates the practice of modeling in the teaching and learning of the concepts of matter and energy in ecosystems.

Binding, M and Brodsky. (2021). Bridging the Gap: Evaluating a Design Approach for Curriculum-Neutral NGSS Benchmark Assessments in Middle School. Presented at the annual meeting of the National Association for Research in Science Teaching.

This paper describes a project led by SEPUP and the Lawrence Hall of Science to develop a comprehensive suite of curriculum-neutral benchmark assessments for the middle school NGSS performance expectations

Binding, M and Brodsky (2022) Designing for Engineering: A Model for Integrating Engineering and Science NGSS Middle School Benchmark Assessments. Presented at the annual meeting of the National Association for Research in Science Teaching.

This paper describes the approach used to address the assessment of the Engineering Design (ETS) Performance Expectations (PEs) in a project by SEPUP and the Lawrence Hall of Science to develop a comprehensive suite of curriculum-neutral benchmark assessments for the middle school NGSS performance expectations

Covello, V. (1999). Risk communication, children's health, and environmental tobacco smoke.

Background Paper Series, International Consultation on Environmental Tobacco Smoke (ETS) and Child Health.

The article gives background on health risks education. It recommends SEPUP as a model program for health risk assessment because of its instructional modules for students and communities.

Draney, K. & Wilson, M. (1997, July). *Mapping student progress with embedded assessments: The challenge of making evaluation meaningful*. Paper presented at the National Evaluation Institute Workshop, Indianapolis, IN.

Describes the development of psychometrically calibrated progress maps that describe student performance on embedded assessments in SEPUP's year-long course *Issues, Evidence and You*.

Dryden, M. & Fraser, B. (1998, April). *Awareness versus acceptance of systemic change among secondary science teachers*. Paper presented at National Association for Research in Science Teaching (NARST) Annual Conference, San Diego.

This paper refers to SEPUP as an exemplary curriculum that has student-student interactions, uses real-life activity-based instruction, and uses oral and written reports and technology.

Ertel, L. (2002, Winter). Out of the classroom and into the real world. *The Link*, 1–2.

The article describes the positive experiences which SEPUP materials provide for both teachers and students.

Horvat, Robert E. (1993). The Science Education for Public Understanding Program: What's new with SEPUP. Additional info: Educational materials. *Bulletin of Science, Technology and Society*, 13(4), 208–210.

This article gives a general description of the SEPUP modules as well as new SEPUP's projects that were being developed at the time of publication.

Kelly, P. J. (1991). *Perceptions and performance: An impact assessment study of CEPUP in schools*.

Berkeley, CA: Science Education for Public Understanding Program.

This study evaluated SEPUP's modules such as "Toxic Waste: A Teaching Simulation and Chemical Survey" and "Investigating Groundwater: The Fruitvale Story." It assessed the changes in student beliefs about science, the use of evidence in scientific reasoning, and students' understanding of the subject matter.

Koker, M. (1992). *SEPUP in Cleveland: An impact study of SEPUP on teachers and students*. Berkeley, CA: Science Education for Public Understanding Program.

The paper discusses the impact of SEPUP curriculum on teachers and students in Cleveland. It found that SEPUP promoted positive teaching strategies and professional behaviors for teachers.

Koker, M. (1992). *SEPUP in Philadelphia: An impact study of SEPUP on teachers and students*.

Berkeley, CA: Science Education for Public Understanding Program.

This study reports differences in student attitudes and knowledge about chemicals between SEPUP and non-SEPUP students, favoring SEPUP. Survey data suggests SEPUP has a positive effect on teachers, including increased use of hands-on strategies, more collaboration with peers, and increased enrollment in in-service methods courses.

Koker, M. (1996). *Students' decisions about environmental issues and problems: An evaluation study of the SEPUP program*. Unpublished Ph.D. Dissertation. University of Southampton, England.

This dissertation used SEPUP to investigate the influence of various factors, such as perception and use of evidence, values, and beliefs, on student decisions about environmental issues and problems. In a controlled study, students using SEPUP were found more likely to use evidence in their decision-making than their non-SEPUP peers.

Koker, M. (2001). *What research says about SEPUP*. Ronkonkoma, NY: Lab-Aids, Inc.

This paper provides a summary of research findings on the effectiveness of SEPUP from 1988–1998, including improved student attitudes towards science and enhanced content knowledge and teacher effects.

Koker, M. & Thier, H. (1994). *Learning about environmental health risks: An evaluation study of the SEPUP "Investigating Environmental Health Risks" module*. Berkeley, CA: Science Education for Public Understanding Program.

This study evaluated the effectiveness of SEPUP Health Risks module, and it concluded that student understanding of basic environmental health risk concepts, such as sampling, acute and chronic toxicity, and dose-effect relationships, was significantly increased with the use of a short (3-week) teaching module. The study involved 585 students in eight states.

Lee, S.A. (2002). *Planning curriculum in science*. Wisconsin Department of Public Instruction. Milwaukee, WI. pp.127–129

The SEPUP course, *Issues, Evidence, and You* is provided as an example of a science program which effectively integrates multiple methods of assessments and provides continuous feedback on students' progress.

Lewis, A. (1996). Content standards for science: NSF panel tells districts which materials meet its standards. *Harvard Education Newsletter*. September/October, 4.

Review of NSF study (see below, under NSF) in which SEPUP is listed as a science program that meets the national science content standards, engages students in science, has an excellent assessment component, and encourages teachers to improve their instruction.

Lewis, A. (1999, Spring). Janet Seibert: High standards "high-jinks" make learning science a ball. *Changing Schools in Louisville*, 3(1). Retrieved March 12, 2003 from www.middleweb.com/CSLV5seibert.html

This article describes the experience of a middle school science teacher/reformer who field tested SEPUP units for its middle school courses and found the assessment system to have a positive effect on her teaching and her students' learning.

Linn, M., Lee, K., Levenson, J., Spitulnik, M., & Slotta, J. (2000). *Teaching and learning K–8 mathematics and science through inquiry: Program reviews and recommendations*. North Central Regional Educational Laboratory.

SEPUP courses, such as *Science and Life Issues*, are recommended as exemplary science curricular materials which meet the following criteria: engage students in inquiry, are personally relevant to students, use technology to enhance learning, meet the needs of diverse students, enable all students to achieve, and support peer learning.

Nagle, B., Hariani, M. & Siegel, M. (2006). Achieving a Vision of Inquiry: Rigorous, Engaging Curriculum and Instruction. In Yager, Robert E. (ed) *Exemplary Science in Grades 5-8: Standards-Based Success Stories*. Arlington, VA: NSTA Press.

Describes programs to implement inquiry-based middle school science education in Lemon Grove, CA and Charleston, SC using SEPUP materials. Includes discussion of SEPUP assessment system and change of emphasis in teaching and curriculum, and evaluates evidence of change in targeted classrooms in these districts.

Nagle, B., Short, J., Wilson, S., and Howarth, J. (2016). *Developing an NGSS-aligned educative middle school ecosystems curriculum unit*. Paper presented at the annual meeting of the National Association for Research in Science Teaching (NARST), Baltimore, MD.

This paper describes the development of a middle school Ecology unit aligned to the Next Generation Science Standards, incorporating three-dimensional lessons and assessments.

Nagle, B., Siegel, M. & Barter, A. (2004, April). *Evolution of life science assessments for middle school.*

Paper presented at the annual meeting of the National Association for Research in Science Teaching (NARST) Annual Conference, Vancouver, BC.

Provides a description and example of how embedded assessment extended response questions for middle school students are written, tested, and revised.

Nagy Catz, K., Lenz, L., & Middaugh, E. (2010). *Addressing Misconceptions in Evolution at the High School Level.* Paper presented at the National Association for Research in Science Teaching Conference, Philadelphia, PA.

This paper provides a summary of student learning from the 2008-2009 field test of Science and Global Issues: Biology, SEPUP's high school Biology program. The paper examines the challenges in student learning of concepts related to evolution and natural selection.

National Science Foundation. (1997) *Review of Instructional Materials for Middle School Science.*

Directorate for Educational and Human Resources, Division of Elementary, Secondary, and Informal Education.

In this evaluation of NSF-sponsored comprehensive curricular materials for middle school, SEPUP is cited as an outstanding example of embedded assessment at the middle school level with engaging materials that provide good opportunities for student-designed inquiry—an exemplary model of using personal and social issue as the pedagogical driver for learning and applying important science concepts.

Ogens, E.M. & Koker, M. (1995, June/July). Teaching for understanding: An issue-oriented science approach. *Clearing House*, 68:6, 343–45.

This article describes SEPUP as a science program that develops scientifically literate individuals who can make informed decisions and who understand the interrelationship among science, technology, and society.

Pogrow, S. (1993). Where's the beef? Looking for exemplary materials. *Educational Leadership* 50, 8: 39–45.

In this article, SEPUP modules are described as supplementary materials that provide content in ways that are creative and rigorous and that make it relevant to student. They also are instrumental in developing students' problem solving and thinking skills.

Ranney, M., Adams, S., Siegel, M., & Brem, S. (1999, April). *Reasoning about the environment: Prototypical cases and their educational implications.* Paper presented at the Fifth Conference on Environmental Education. Zurich, Switzerland.

The paper discusses the results of a study in which students used “Convince Me,” a software program which facilitates students' reasoning about hypotheses and evidence on social issues.

Ranney, M., Siegel, M., Weidner, J., & Nelson, J. (1997). *How to persuade “Convince Me”: Subjects' interactions with our “reasoner's workbench” software.* Paper presented at the Fourth Annual Meeting of the Cognitive Science Association for Interdisciplinary Learning. Hood River, Oregon. The “Convince Me” program is a computer-learning environment that helps students to create, manage, and evaluate arguments. This paper presents describes students' interactions with the program.

Ratcliffe, M. (2004, April). *Science and sustainability: Evaluation of integration of science concepts with global issues*. Paper presented at the annual meeting of the National Association for Research in Science Teaching (NARST) Annual Conference, Vancouver, BC.

This paper provides an independent study and assessment of how effectively the *Science and Sustainability* course manages to integrate the study of scientific concepts with the study of issues of global citizenship, both in theory (by evaluation of the textbook) and in practice (by analyzing teacher evaluations from S&S field test centers).

Roberts, L. (1996). *Methods of evaluation for a complex treatment and its effects on teacher professional development: A case study of the Science Education for Public Understanding Program*.

Unpublished doctoral dissertation, University of California at Berkeley.

This dissertation studies teacher professional development among teachers who used only the SEPUP middle school course, *Issues, Evidence and You*, and those who used both the course and its embedded assessment system. The results of the study show that teachers using both the course and its assessment system increased their uses of alternative assessment strategies. Also, teacher change was facilitated by the leadership, institutional support, and peer support provided by the Assessment Development Centers in schools that were field-testing the SEPUP materials.

Roberts, L. & Wilson, M. (1998). *Evaluating the effects of an integrated assessment system: Changing teachers' practices and improving student achievement in science*. (BEAR Report Series, SA-98-2) University of California, Berkeley.

In this paper, the findings are presented from a 2-year project that studied the effects of the embedded assessment system in the SEPUP course, *Issues, Evidence, and You*. The results showed a positive change in teacher assessment practices and student achievement.

Roberts, L., & Wilson, M. (1998). *An integrated assessment system as a medium for teacher change and the organizational factors that mediate science teachers' professional development*. (BEAR Report Series, SA-98-2) University of California, Berkeley.

This paper describes the SEPUP assessment system and provides a summary of factors influencing teacher professional development.

Roberts, L., Sloane, K., & Wilson, M. (1996). *Local assessment moderation in SEPUP*. Paper presented at the annual meeting of the American Educational Research Association, New York, NY. Assessment moderation is a procedure in which teachers (or scorers) meet to reach a consensus on scores on student work. This paper discusses the process of moderation among teachers using the SEPUP curriculum.

Roberts, L., Wilson, M., & Draney, K. (1997). *The SEPUP assessment system: An overview*. (BEAR Report Series, SA-97-1) University of California, Berkeley.

This paper provides a detailed discussion of SEPUP's system of embedded assessment in its year-long course, *Issues, Evidence and You*.

Samson, S. & Wilson, M. (1996). *The SEPUP Issues, Evidence and You curriculum: Achievement and student attitude evidence from the pilot year*. Paper presented at the Annual Conference of the American Educational Research Association, New York.

This study evaluated the effectiveness of SEPUP's year-long course, *Issues, Evidence, and You*. It looked at student achievement and attitudes toward science and found that students using this course were more likely to provide scientific evidence for their reasoning and to believe that science was more relevant to their lives.

Scott, G. (2000). Integrated science study. *Science Teacher*, 67 (6), 56–59.

This paper reports on gains in student achievement as a result of a two-year integrated science sequence in Los Angeles Unified School District. In many of the participating schools, the integrated science sequence was based on two SEPUP courses: *Issues, Evidence and You* and *Science and Sustainability*.

Seiki, S., Asato, J., Koo, B., & Hariani, M. (2022) *Transformative Curriculum-Making: Creating Accessible Science*. Paper presented at the Annual Conference of the American Educational Research Association, San Diego, CA.

This paper explores ways to prepare teachers to make science curriculum accessible and draw on student’s community cultural knowledge through a theoretical framework and pedagogical practice called Transformative Curriculum Making, and describes a pilot inquiry conducted in partnership between SEPUP and the creators of Transformative Curriculum Making.

Siegel, M.A., & Thier, M. (2002). *Issue-oriented elementary science leadership*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, New Orleans, LA. This article describes the partnerships between SEPUP’s *Chemicals, Health, Environment and Me (CHEM)* program and ten school districts to build teacher leadership and to improve science learning. The results suggest that teaching, content knowledge, confidence, leadership, and district programs were enhanced in 8 of the 10 districts.

Siegel, M.A. (1999). *Changes in student decisions with Convince Me: Using evidence and making tradeoffs*. In Proceedings of the Twenty First Annual Conference of the Cognitive Science Society, 671–676.

This study describes the decision-making process of *Science and Sustainability* high school students who analyzed scientific evidence about issues of technology and society using a computer program called *Convince Me*.

Siegel, M.A. (1999). *Teaching science for public understanding: Developing decision-making abilities*.

Unpublished doctoral dissertation, University of California, Berkeley.

This dissertation investigated how students’ decision-making skills and attitudes toward science changed over one year. A 10th grade *Science and Sustainability* class was compared to one which also used the computer program, *Convince Me*.

Siegel, M.A., Hynds, P., & Thier, M. (2002). Scaling our work: The ESTL Project as an example of a learning sciences reform. In Bell, P., Stevens, R., and Satwicz, T. (Eds.) *Keeping Learning Complex: The Proceedings of the Fifth International Conference of the Learning Sciences*.

Mahwah, NJ: Erlbaum.

This panel summary describes the ESTL professional development project’s approach to instigating educational reform. It is part of a larger paper called “The Learning Sciences in Schools: Strategies for Working with Teachers and Instigating Reform.”

Siegel, M.A., Hynds, P., Siciliano, M., & Nagle, B. (2006). Using rubrics successfully: How to foster meaningful learning and self-assessment. *PEERS (Practical Experience and Educational Research) Matter*. Washington DC: Joint publication of NSTA and NARST.

The paper was designed to help teachers use assessment as a learning tool. It also provides background on the SEPUP assessment system and discusses how SEPUP assessment scoring guides (rubrics) are used in classrooms.

Siegel, M.A., Nagle, B. & Barter A. (2004, April). Development of an assessment instrument for middle school life science: design consideration and consequences related to scoring student learning with rubrics. Paper presented at the annual meeting of the American Educational Research Association (AERA), San Diego, CA.

This paper specifically addresses the issues behind fine tuning task-specific scoring rubrics for extended answer questions administered to seventh grade students.

Siegel, M.A., & Ranney, M.A. (2003). Developing the Changes in Attitude about the Relevance of Science (CARS) questionnaire and assessing two high school science classes. *Journal of Research in Science Teaching*.

This article describes the development of the Changes in Attitude about the Relevance of Science (CARS) questionnaire. This questionnaire was used to determine changes in attitudes toward science among students using the *Science and Sustainability* field test.

Snell, V., Baumgartner, L., & Seaver, D. (2000). Design & Decision Making. *The Science Teacher*, 67(6), 29–31.

This article describes how SEPUP uses current issues and guided inquiry in *Science and Sustainability* to motivate and help students learn to design their own experiments and become proficient in making evidence-based decisions.

Thier, H. D. & Nagle, B. (1994). Developing a model for issue-oriented science. In J. Solomon, G. Aikenhead (Eds.), *STS Education: International perspectives on reform*. (Ways of Knowing Science Series). New York: Teachers College Press, 75–83.

This paper discusses the development of CEPUP / SEPUP as a model Science, Technology, and Society (STS) curriculum. The SEPUP model fully integrates science content around personal and societal decisions about issues involving science and technology.

Thier, H.D. (1995). The role of the Lawrence Hall of Science in an era of standards-based reform. In Bybee, R.W. & McInerney, J. (Eds.) *Redesigning the science curriculum: A report on the implications of standards and benchmarks for science education*, 63–65.

The article discusses the goals of Lawrence Hall of Science to improve science and mathematics education for all students through research, teaching, and public service.

Thier, H.D. Structuring successful collaborations between developers and assessment specialists. In *Towards Coherence Between Classroom Assessment and Accountability* by Mark Wilson (Ed). 2004. The 103rd Yearbook of the National Society for the Study of Education, Part 2, pp 250–263. This paper offers an overview of the five chapters that make up the core of the book with their differing models and approaches to quality assessment approaches.

Thier, H. D. & Peterson, L. (1988, Spring). Child's Play. *Chapter One*, 2(1), 46–48.

This provides an overview of the development and goals of the Chemical Education for Public Understanding Project (CEPUP) at the Lawrence Hall of Science in Berkeley, California during its first years.

Thier, H. D., Seaver, D.B. & Walhof, L.K. (1999). Development and assessment of *Science and Sustainability*, the SEPUP issue-oriented high school science course. In *Proceedings of the Ninth International Organization for Science and Technology Education (IOSTE) Symposium*.

The paper describes several elements of SEPUP's curriculum development process using examples from the high school course, *Science and Sustainability*. It also highlights the course content and assessment system.

Thier, H., Giralt, F., Medir, M., & Grau, F.X. (1994). A holistic approach to ChE education: Professional and issue-oriented approach. *Chemical Engineering Education* 28(2), 122–127.

This study describes how a professional and issue-oriented approach was used in a Chemical Engineering college class instead of the traditional lecture-based approach. Results showed that compared to traditional courses, with this approach students were more open and interactive with one another and they handled new learning situations better.

Thier, H.D. & Daviss, B. (2001). *Developing inquiry-based science materials: A guide for educators*. Teachers College Press. New York, NY.

This is a practical research-based book that provides a comprehensive guide to designing activities for K–12 students. It thoroughly describes the process of curriculum development, from the initial idea and pursuit of funding through development, field testing, revision, and publication of a final product. Principles for designing guided inquiry materials are also discussed. Examples are provided from several curriculum development programs, including several SEPUP projects.

Thier, H.D. & Hill, T. (1988). Chemical education in schools and the community: The CEPUP project. *International Journal of Science Education*. 10(4), 421–430.

This paper gives an overview of the CEPUP project such as the goals and approach. It describes the development of instructional materials and the dissemination of the program.

Thier, H.D., & Siegel, M. (1997). *Risk education in secondary school science*. Paper presented at the Annual Meeting of the Environmental Occupation and Health Safety Institute, New Brunswick, New Jersey.

This paper describes the importance of risk education and how to develop materials that align with the National Science Education Standards. It also reviews current risk curriculum.

Thier, M. (1997, Spring). The CHEM tool kit for curriculum integration. *CSTA Journal*. 26–36.

This article discusses the importance of integrating issue-oriented science programs like CHEM-2 into the classroom curriculum. It describes the components of the CHEM-2 program as effective methods to engage students in critical science thinking that is relevant to their lives.

Thier, M. & Daviss, B. (2002). *The new science literacy: Using language skills to help students learn science*. Portsmouth, NH: Heinemann.

This book describes effective strategies to teach science through language literacy.

Willcox, M., Howarth, J., Jackson, W., and Nagle, B. (2017). Designing and Field Testing a Middle School Ecosystem Unit for the NGSS. Paper presented at the annual meeting of the National Association for Research in Science Teaching, San Antonio, TX.

This paper describes the development and field-testing of a middle school Ecology unit aligned to the Next Generation Science Standards, incorporating three-dimensional lessons and assessments.

Willcox, M., Jackson, W., Howarth, J., and Kastel, D. (2017). Designing an NGSS-aligned middle school ecosystems unit using the *Five Tools and Processes for NGSS*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, San Antonio, TX.

This paper describes the use of the Five Tools and Processes for developing a middle school Ecology unit aligned to the Next Generation Science Standards.

Wilmes, S., & Howarth, J. (2009). Using Issues-based Science in the Classroom. *The Science Teacher*, Volume 76, October, pg. 24 – 29.

This article describes how to use issues and inquiry to design lessons that address science standards. The characteristics of issue-oriented classrooms, selecting good issues, and the use of SEPUP's evidence and trade-offs scoring guide are discussed.

Wilson, K. G., & Daviss, B. (1994). *Redesigning education*. New York, NY: Henry Holt and Company. The book discusses SEPUP as an effective educational design which bases curriculum on research, integrates technology into the curriculum, and pilots course materials in real classrooms, as well as providing teacher professional development.

Wilson, M. & Draney, K. Some links between large-scale and classroom assessments: The case of the BEAR assessment system. In *Towards Coherence Between Classroom Assessment and Accountability* by Mark Wilson (Ed). 2004. The 103rd Yearbook of the National Society for the Study of Education, Part 2, pp 132–154.

This paper describes a method of integrated classroom assessment and scoring (the BEAR method) which is curriculum centered and allows coordinated assessments at the classroom, school district, statewide, and national levels.

Wilson, M., Sloane, K., Roberts, L., & Henke, R. (1995). *SEPUP Course I, Issues, Evidence and You: Achievement evidence from the pilot implementation*. (BEAR Report Series, SA-95-2) University of California, Berkeley.

This report gives evidence of student achievement after using SEPUP's course, *Issues, Evidence, and You*. The pre-test and post-test results showed that the average SEPUP student showed improvement in providing evidence and using trade-offs in scientific arguments.

Wilson, M., Thier, H., Sloane, K., & Nagle, B. (1996, April). *What have we learned from developing an embedded assessment system?* Paper presented at the annual meeting of the American Educational Research Association, New York.

Describes the collaboration of curriculum developers and assessment researchers in developing the SEPUP/BEAR Assessment System.

Wilson, M., & Sloane, K. (2000). From principles to practice: An embedded assessment system. *Applied Measurement in Education*, 13(2), 181–208.

This article describes the principles that guided the development and implementation of the BEAR (Berkeley Evaluation and Assessment Research) Assessment System that was created for SEPUP's middle school course, *Issues, Evidence, and You*.