Quick Guide: Chemistry Service-Learning in Higher Education

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*For additional resources on these and other service-learning topics visit the National Service-Learning Clearinghouse Website at **www.servicelearning.org***

Service-learning in the chemistry curriculum provides a rich opportunity for students to learn while contributing to their communities. Service-learning in higher education integrates community service with academic instruction. Students participate in organized curricular projects that address community needs, while enhancing their academic knowledge and skills and fostering civic responsibility.

Some examples of chemistry service-learning projects at the post-secondary level include: teaching students about lead poisoning avoidance while assessing and analyzing lead content in the paint of older homes; mentoring 'at-risk' students in chemistry; leading hands-on science projects at middle and high-schools; and monitoring environmental quality as a component of environmental improvement projects. Participation in these types of service-learning experiences may help students gain an understanding and appreciation of their role as scientists in society at large, while reinforcing core competencies in the chemistry curriculum. Additionally, service-learning has the power to provide a real world context for analyzing and applying scientific and professional ethics. In effect, service-learning may cement ties between future scientists and the community.

To better achieve the *National Education Goals*, including "The United States will be first in the world in mathematics and science achievement"; the National Science Foundation (NSF) and others have developed several initiatives to enhance chemistry education and knowledge retention. One example is the NSF's '*New Traditions Project'* which aims to create a paradigm shift from faculty-centered to student-centered learning throughout the chemistry curriculum.

This project summarizes why chemistry curricular reform is necessary, including examples of curricula that:

- *place course content in the context of real scientific or societal problems*
- *accommodate different learning styles corresponding to diverse students*
- *convey interest and intrigue in the field of chemistry*

Service-learning is one teaching methodology that can play a role in achieving all of the above goals.

Web Resources

National Science Foundation New Traditions Project. Madison, WI: University of Wisconsin, 1997.
http://newtraditions.chem.wisc.edu/

> This project aims to shift the paradigm of chemistry education to be student-centered, and delineates a number of goals which may be achieved through the use of service-learning as a teaching methodology.

Campus Compact Discipline Specific Syllabi (Chemistry)
http://www.compact.org/syllabi/

> The Campus Compact website offers discipline specific syllabi that incorporate service-learning. Simply click on Browsing the Syllabi and select Chemistry to see examples. This website is updated frequently, so check back often for new examples.

ERIC Clearinghouse on Science, Math and Environmental Education: Science
http://www.ericse.org/sciindex.html

> ERIC (Educational Resources Information Center) is a national information system funded by the U.S. Department of Education's Institute of Education Sciences to provide access to education literature and resources.

Service-Learning in Analytical Chemistry: The Neighborhood as a Laboratory. Henderson David E. and Janet F. Morrison. Hartford, CT: Trinity College, 2002.
http://www.trincoll.edu/~henderso/textfi~1/SERVICE%20LEARNING%20IN%20ANALYTICAL%20CHEMISTRY%20FACSS%202002%20%5BRead-Only%5D.pdf

> This PowerPoint presentation provides an overview of educational theories behind scientific teaching, as well as examples of experiential projects that teach basic chemistry projects. The presentation ends with recommendations for developing successful chemistry projects in the community.

Science Service-Learning at the University of Washington. Seattle: University of Washington, 1998.
http://depts.washington.edu/ssl

> Science Service-Learning is a course taught through the University of Washington Chemistry department in Seattle, Washington. Through community service, scientific skills are broadened and deepened as students work with pre-college students and community volunteers on projects that are both meaningful and relevant to their interests and needs. One

of the chemical education division's most innovative projects is the Native American Science Outreach Network.

Service-Learning Resources for Students. Washington, DC: American Chemical Society, 2003. http://www.chemistry.org/portal/a/c/s/1/acsdisplay.html?id=8e2c63e8378e11d7e1dc6ed9fe800100

The American Chemical Society (ACS) is a membership organization with members involved in chemistry practice and education. This page offers links to articles in the ACS journal Chemistry that discuss and detail service-learning programs in Chemistry.

University of Utah: General Chemistry Service-Learning Syllabus. Eyring, Ted. 1996. http://csf.colorado.edu/sl/syllabi/chemistry/eyring121.html

This general chemistry course syllabi details the integration of service-learning into a large chemistry course (over 200 students).

Vanderbilt Student Volunteers for Science: After School Activity. Joesten, M.D., and P.C. Tellinghuisen. Nashville: Vanderbilt University, 2001. http://www.vanderbilt.edu/vsvs/chro.pdf

This detailed description of an after-school activity for students focused on chromatography and food colors was also published in the Journal of Chemical Education 78, no. 4 (2001): 463-66.

Hints for Developing a Chemistry Service-Learning Class. Fitch, Alanah. Chicago: Loyola University, no date. http://www.luc.edu/chemistry/faculty/fitch/fitchgroup/Service_Learning/Hints/hints.html

Loyola University Chicago faculty member Alanah Fitch provides hints on developing a service-learning course in chemistry based on her experiences combining undergraduate courses in instrumental analysis with real community issues to incorporate service-learning into the classroom. Examples include an analysis of the problem of lead in the city of Chicago.

Service-Learning in Chemistry. Springfield, MO: Southwest Missouri State University Department of Chemistry, 2003. http://chemistry.smsu.edu/Syllabi/Spring%202003%20Syllabi/300%20Level%20Syllabi.htm#CHM%20300

At this site a brief overview of Chemistry 300, Service-Learning in Chemistry, is provided. This overview details course requirements and assignments related to service-learning, as well as how the course is related to other chemistry course work.

Print Resources

Brennan, M. “Service-Learning In Science Takes Off.” *Chemical and Engineering News* 76, no. 17 (May, 1998): 46.

> A number of chemists, faculty, and staff are using the service-learning approach in teaching chemistry to students. Examples are provided.

Campus Compact. *Science And Society: Redefining the Relationship*. Washington, DC: Learn and Serve America and Education Commission of the States, 1996. http://www.servicelearning.org/wg_php/library/index.php?library_id=489

> In an attempt to provide instructive models of the design and implementation processes commonly associated with service-learning courses, this publication maps the development of 18 service-learning courses in the SEAMS (Science, Engineering, Architecture, Mathematics, Computer Science) disciplines at the high school and college levels.

Carr, K. “Building Bridges And Crossing Borders: Using Service-Learning To Overcome Cultural Barriers To Collaboration Between Science And Education Departments.” *School Science and Mathematics* 102, no. 6 (October, 2002): 285-98. http://www.servicelearning.org/wg_php/library/index.php?library_id=4810

> This article describes several successful and unsuccessful collaboration efforts between scientists and educators that took place during the creation of an interdepartmental service-learning project, Science Outreach, at George Fox University.

Hatcher-Skeers, M., and E. Aragon. “Combining Active Learning with Service-Learning: A Student-Driven Demonstration Project.” *Journal of Chemical Education* 79, no. 4 (April, 2002): 462-64.

> Chemical demonstrations are used as an active-learning tool in a general chemistry course and as a method of outreach to a local middle school. The demonstrations are planned and prepared by groups of students, who first present them to their classmates and then take them to a middle school to present them to groups of middle school children in an event known as Chemistry Day.

Kesner, L., and E. Eyring. “Service-Learning General Chemistry: Lead-Paint Analyses.” *Journal of Chemical Education* 76, no. 7 (July, 1999): 920-23.

> Older houses painted with lead-based paints are ubiquitous in the United States two decades after federal regulations prohibited inclusion of lead in paint. Remodeling older homes thus poses a health threat for infants and small children living in those homes. In a service-learning general chemistry class, students disseminate information about this health threat in an older neighborhood. The sample preparation for atomic absorption spectroscopic (AAS) analysis enhances their laboratory skills. The focus of this paper is

on the mechanics of integrating this particular service project into the first-term of the normal general chemistry course.

Kraft ,R., and James Kielsmeier, J. *Experiential Learning in Schools in Higher Education*. Boulder, CO: Association for Experiential Education, 1995. http://www.servicelearning.org/wg_php/library/index.php?library_id=2836

Based on John Dewey's belief that all genuine education comes through experience, this book, which includes four sections, aims to inform educators, administrators, and researchers in schools and institutions of higher education as they seek to put experiential education into practice. Section Three examines applications of experiential education in the classroom, including general educational strategies and mathematics and science projects, among others.

Langseth, M. "From Shakespeare to Chemistry: Service-Learning and Academic Pursuits." *Thresholds in Education* 22, no. 2 (1996): 22-24. http://www.servicelearning.org/wg_php/library/index.php?library_id=2873

The Minnesota Compact is a coalition of 45 college and university presidents seeking to encourage student involvement in community and public service and strengthen the effects of that service on communities and students. Service-learning efforts are most successful when certain elements are present: collaborative relationships with community partners, integration of service experiences with academic objectives, and evaluation of student and community outcomes.

Ritter-Smith, K. *When Community Enters the Equation: Enhancing Science, Mathematics and Engineering Education Through Service-Learning*. Providence, RI: Campus Compact, 1998. http://www.servicelearning.org/wg_php/library/index.php?library_id=3446

An anthology of essays related to service-learning in the physical sciences. Includes article: *"Reflection in science courses: is it feasible?"* (chemistry)

Strait M, and D. Wiegand. "What Is Service-Learning?" *Journal of Chemical Education* 77, no. 12 (December, 2000): 1538.

Environmental and analytical chemistry courses provide a background for introducing students to using their scientific skills to work with their community and thereby gain an understanding of their role as scientists in society. The American Chemical Society, recognizing the potential of service-learning in the chemistry curriculum, convened a group of faculty to examine how service-learning can best fit into its programs.

Ward, H. *Acting Locally: Concepts and Models for Service-Learning in Environmental Studies.* American Association for Higher Education Series on Service-Learning in the Disciplines. Washington, DC: AAHE, 1999. http://www.servicelearning.org/wg_php/library/index.php?library_id=3936

Includes article: *The ethics of community/undergraduate collaborative research in chemistry* by Fitch et al.