Chemistry Service Learning: A Resource Sheet

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I. General Info. about Chemistry Service Learning

1)Quick Summary of what service-learning in Chemistry is!
By Deborah Wiegand and Melissa Strait in Chemical Education Today
http://jchemed.chem.wisc.edu/Links/Journal/JCE2000p1538.pdf

2) Deborah Wiegand: Professor of Chemistry @ Washington University
Summary of her courses and evaluations of the effectiveness of service learning as an undergraduate teaching technique.
http://depts.washington.edu/uweek/archives/uw_2000/s_sterling_munro.html
"Wiegand pioneered science service learning in the UW chemistry department in 1994, and more than 1,000 students have taken part. They have led hands-on science projects in area elementary schools, mentored at-risk kids in science activities, monitored water quality in area streams and helped high school teachers in DNA sequencing projects."

3) Chemistry and Service Learning in Higher Education:
Learn and Service America's National Service-Learning Clearinghouse Chemistry Resource Sheet
A fact sheet summary of all web and print resources for Chemistry in higher education. Most of the resources included in this resource sheet are also included in this resource sheet.
http://www.servicelearning.org/instant_info/fact_sheets/he_facts/chem_he/

4) American Chemical Society: Service Learning Resources for Chemistry Faculty
http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_ARTICLEMAIN&node_id=182&content_id=WPCP_011105&use_sec=true&sec_url_var=region1#P128_6464
"The American Chemical Society (ACS) is a membership organization with members involved in chemistry practice and education. This page includes general information on how to design a service-learning course in Chemistry."
***Also see American Chem. Societies list of INTERNSHIPS and Cooperative Education Programs (Coops)
http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_ARTICLEMAIN&node_id=182&content_id=WPCP_011106&use_sec=true&sec_url_var=region1&__uuid=47a60a25-1274-466a-8758-795f6034722a

5) 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."

6) Hints for Developing a Chemistry Service-Learning Class: Dr. Alanah Fitch: Loyola University
http://www.luc.edu/faculty/afitch/Hints.htm
**Includes a Lead lab course syllabus outline.
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 Courses taught by Prof. Fitch
http://www.luc.edu/faculty/afitch/Classes.htm

7) PowerPoint Introduction to Chemistry Service Learning @ Missouri State University
www.chem.purdue.edu/bcce/P489jahnke_service_learning.ppt
This power point explains evaluations/analysis of a service learning program where chemistry students do individual service learning projects in the community.
**Syllabus for this one-credit Service Learning in Chemistry class (not connected to other Chemistry courses): by Dr. Annette Gordon
http://chemistry.missouristate.edu/assets/chemdept/CHM_300_Syllabus_Gordon.pdf

II. Syllabi & Ideas for Classes

A) Variety of Chemistry Courses

1) 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.

2) A) Department of Chemistry Service Learning Programs @ University of Washington
http://depts.washington.edu/chem/undergrad/commsvccourses.html

B) Science Service-Learning @ the University of Washington
http://depts.washington.edu/ssl/Main/main.html
*This page offers links to articles in the ACS journal Chemistry that discuss and detail service-learning programs in Chemistry.
*Service learning courses at the University of Washington:
http://depts.washington.edu/chem/undergrad/commsvccourses.html
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.

3) Chem. 300: Service-Learning Course
By Southwest Missouri State University Department of Chemistry
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.

4) Chemistry Outreach Programs at the University of Washington
http://depts.washington.edu/chem/undergrad/commsvccourses.html#satm
Science Service Learning, CHEM 197/297/397 is a series of courses offered through the Department of Chemistry that gives students the chance to combine their science backgrounds with community service activities.

5) General Chemistry Service-Learning Syllabus @ University of Utah:. 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).
http://chemistry.missouristate.edu/assets/chemdept/CHM_300_Syllabus_Gordon.pdf

6) Chemistry 104
http://www.servicelearning.org/slice/index.php?ep_action=view&ep_id=454
Chemistry 104 is the first term of a one-year sequence in General Chemistry. The course is designed for nursing and allied health sciences as well as such disciplines as fire science, respiratory therapists, medical technology, biotechnology, and dental hygiene requirements. Includes a service-learning component.

7) Chemistry Communications Syllabus
http://chemistry.clemson.edu/undergrad/syllabi/CH152%20syllabus%20-%20Kaup%20-%202009.pdf
"Methods for scientific communication including oral, written, and electronic formats. Service-learning projects engage participants with community needs pertaining to chemistry issues. Satisfies 1 hour of General Education oral communications credit."

8**) Community-Campus Partnerships for Health**:
http://depts.washington.edu/ccph/servicelearningres.html
FEATURING: **A) Syllabi** from Health-related courses (including interdisciplinary courses in the social sciences and humanities).

B) Funding information and sample project ideas.

CCPH is a nonprofit organization that promotes health (broadly defined) through partnerships between communities and higher educational institutions. Founded in 1996, we are a growing network of over 1,800 communities and campuses across North America.

B) Analytical Chemistry

1) Analytical Chemistry SL: 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.

2) Analytical Chemistry in the Community Workshop: List of speakers and descriptions of their presentations
http://ca.pittcon.org/technical+program/TPAbstra09.nsf/SA/B89E3F7AA22560C185257481005ED7FD?opendocument

Service learning is an effective pedagogical tool in which students serve the community and that service is connected to learning goals for a course. Analytical chemistry is ideally situated for implementation of service learning in the chemistry curriculum. In this workshop, speakers from both academia and non-profit organizations will share case studies and best practices associated with service learning.

A)Service Learning in Environmental Analytical Chemistry by Dr. Joseph A Gardella
http://ca.pittcon.org/technical+program/TPAbstra09.nsf/Agenda+Time+Slots+Web/5C51A7F6BA2B80658525749C006E2F70?Opendocument&showback=yes

B) Integrating Portable X-ray Fluorescence into Service-Based Projects in Analytical Chemistry and Environmental Science Courses
By Prof Keith E. Miller @ the University of Denver
http://ca.pittcon.org/technical+program/TPAbstra09.nsf/Agenda+Time+Slots+Web/2203B0F5754CE1C3852574A10074F91E?Opendocument&showback=yes
"Students in an environmental chemistry course (Winter 2007) first performed an initial site assessment of shores of the lake that included a survey for heavy metals and petroleum hydrocarbons in surface soils. Using a portable X-ray fluorescence (PXRF) instrument allowed the students to rapidly acquire metal concentrations in site soils and analyze the data to see if these concentrations exceeded EPA risk-based cleanup guidelines appropriate for the site use conditions."

3) Analytical Sciences Digital Library
Role Playing, Cooperative Learning, and Case Study Classes = a great jumping-off point for service learning projects in the curriculum.
http://www.asdlib.org/list.php?mainCategory=Pedagogy&subCategory=best%20practices

C) Environmental Chemistry

1) A) Seattle University Project on the Environment and Recycling (SUPER)
By Jennifer Sorensen, Ph.D.; Director of General Science Program, Assistant Professor of Chemistry and General Science at Seattle University
http://fac-staff.seattleu.edu/sorensj1/web/super/index_super.html

The Seattle University Project on the Environment and Recycling was initiated in June 2000 to allow chemistry students an opportunity to participate in service learning. We sponsor several research projects at Seattle U. that focus on environmental issues around campus.
***Includes multiple class syllabi and Project findings/reports

B) Jennifer Sorensen, Ph.D.; Director of General Science Program, Assistant Professor of Chemistry and General Science at Seattle University; Director of SUPER.
http://fac-staff.seattleu.edu/sorensj1/web/bottom_files/sorensen.html

2) Environmental Water Quality Analysis Class description
Includes chemistry and biological data collection and analysis.
www.indianacampuscompact.org/LinkClick.aspx?link=SCotePresentation.ppt&tabid=132&mid=686

3) Applied Environmental research Lab (AERL) @ Vancouver Island University
http://web.viu.ca/AERL/

"The Applied Environmental Research Laboratories are equipped for air, soil, and water analysis by both traditional and emerging methods. The AERL team has a range of expertise and access to instrumental methods used to identify and quantify contaminants and naturally occurring substances. Many of our projects involve the development and use of Membrane Introduction Mass Spectrometry (MIMS) for real-time, ultra trace level analysis of volatile and semi-volatile compounds.
***The AERL specializes in collaborative research projects involving faculty, students, private sector and community partnerships."

4) Virginia Water Resources Research Center: Environmental Research Education and Public Outreach at Virginia Tech
http://www.vwrrc.vt.edu/
The Water Center was established at Virginia Tech in 1965 by the U.S. Congress as one of the nation's 54 water institutes and is affiliated with the College of Natural Resources of Virgina Tech. The center's mission is to offer research and educational opportunities to water scientists and students, and provide citizens and government leaders with water science information.
This Research Center, along with funding from the EPA, created many programs centered on chemical testing of the water with students at Virginia Tech. Please see the Environmental Resource Sheet for a listing of some of these programs.

D) College Students Do Chemistry Activities w/ K-12 Youth

1) A) Vanderbilt Student Volunteers for Science (VSVS)
http://studentorgs.vanderbilt.edu/vsvs/New%20VSVS%20Site/lessons.htm

"VSVS is a service organization composed of undergraduate, graduate, and medical students who are committed to bringing inquiry-based, hands-on science lessons to middle-school students." This Program began in 1994 and has grown from serving 8 classes per semester to 121 classes per semester.

**Site includes Lessons for over 50 chemistry, physics, and biology/environmental activities to do with 5th and 6th graders. "Lessons include: Cryogenics, iron in cereal, polymers, rates of chemical reactions, light, UV light, and dry ice."

B) Example of a Chemistry 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.

2) ChemDemo Service Learning Program at Louisiana State University
http://www.lsu.edu/highlights/061/chem.html
In its eight-year history, LSU's ChemDemo program has become the nation's largest service-learning science outreach program in the nation. The program has brought a powerful hands-on science education mission to a number of classes, sending more than 4,400 LSU students to more than 2,100 Louisiana schools, where they offer demonstrations to more than 50,000 students in grades K-12.
**Also see: LSU Chem. Prof. George Stanley Named LSU Service_larning Fellor for his ChemDemo Program:
http://www.lsu.com/unv002.nsf/(NoteID)/1E83CFE04C9C97B386256FE0006C96E7?OpenDocument

3) Joseph A. Gardella's K-16 Interdisciplinary Science and Engineering Partnership
http://www.acsu.buffalo.edu/~gardella/k16.htm
Professor Gardella is Professor of Chemistry at SUNY Buffalo. His research interests are in quantitative analysis and surface chemistry, broadly applied to the study of environmental effects at polymer surfaces and tissue engineering with synthetic biomaterials, and have resulted in some 220 publications and a similar number of invited talks worldwide.

4) Kids Chemistry Day @ Kiktland Community College
http://kirtland.edu/news/releases/2005/12052005-1.htm

5) Chemistry 109: Sharing Chemistry with the Community @ Duke University
By: Prof. Kenneth S. Lyle
http://www.chem.duke.edu/outreach/109.php

III. Partnering Organizations

A) Ohio Resources

1) Alford Center for Service Learning at Denison University
http://www.denison.edu/campuslife/servicelearning/

2) Ohio Campus Compact: Supports Academic Service Learning in all disciplines.
http://www.ohiocampuscompact.org/

B) National Resources

1) The Chemical Educational Foundation (CEF)
http://www.chemed.org/
**Great organization to partner with to do outreach to grades K-8.
"CEF is a nationally recognized, award winning non-profit organization that is dedicated to enhancing grade K-8 students' exposure to science by emphasizing the central role of chemistry in everyday life. In accordance with our mission, CEF has developed several important programs that encourage collaboration among the chemical industry, educators, and all community members to foster

a greater understanding of the science of chemistry, the benefits of chemicals, and the importance of chemical safety awareness."

2) National Science Foundation Funding
http://www.nsf.gov/funding/

3) Chemists Without Borders
http://www.chemistswithoutborders.org/
Chemists Without Borders is a public benefit, non-profit, international humanitarian organization designed to alleviate human suffering through the use of proven chemical technologies and related skills.

IV. Recommended Journal Resources

Brennan, M. (1998). Service-learning in science takes off. *Chemical and Engineering News*, 76 (17), 46.
A number of chemists, faculty, and staff are using the service-learning approach in teaching chemistry to students. Examples are provided.

Carr, K. (2002). Building bridges and crossing borders: Using service-learning to overcome cultural barriers to collaboration between science and education departments. *School Science and Mathematics*, 102(6), 285-98.
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.
<http://eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=EJ656404&ERICExtSearch_SearchType_0=no&accno=EJ656404

Cracolice, M.S., & Ward, K. (1998). Integrating service learning into the college chemistry curriculum. *Chemical Educator*. 3(3), 1-11.
" General chemistry students often complain that they are unmotivated because they see no applications of chemical principles in 'real life.' Instructors become frustrated by these complaints because they see the world as nothing less than a cornucopia of applications of chemistry. How can students learn that chemistry does apply to real life? In this paper, we describe *service learning*, a powerful strategy for integrating chemistry, community service, and real-life applications in the general chemistry curriculum."
<http://www.springerlink.com/content/x886n12x42654575/>
OR <http://chemeducator.org/bibs/0003003/00030213.htm>

Draper, A. J. (2004). Integrating project-based service-learning into an advanced environmental chemistry course. *Journal of Chemical Education*, 81(2), 221-224.
"In an advanced environmental chemistry course, the inclusion of semester-long scientific service projects successfully integrated the research process with course content. Each project involved a unique community-based environmental analysis in which students assessed an aspect of environmental health."
<http://www.servicelearning.org/library/lib_cat/index.php?library_id=5712>

Esson, J.M., Stevens-Truss, R., & Thomas, A. (2005). Service-learning in introductory chemistry: Supplementing chemistry curriculum in elementary schools. *Journal of Chemical Education*, 82(8), 1168-1173.
"The service-learning project involving the second term of introductory chemistry at Kalamazoo College and a local elementary school is a success. The students' responses toward the service-learning project are positive and there is evidence that this project is increasing the number of students who eventually become chemistry majors."
<http://eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=EJ726061&ERICExtSearch_SearchType_0=no&accno=EJ726061

Gardella, J.A. Jr., Milillo, T. M., Sinha, G., Oh, G., et al. (2007). Linking community service, learning, and environmental analytical chemistry. *Analytical Chemistry*, 79(3), 810-818.

Houghton, T., & Kalivas, J.H. (2000). Implementation of traditional and real-world cooperative learning techniques in quantitative analysis including near infrared spectroscopy for analysis of live trout. *Journal of Chemical Education*, 77, 1314-1318.

Journal of Chemical Education. Published by the American Chemical Society.

Kalivas, J.H. (in press). An elementary school service learning project based on a research supportive curriculum format in the general chemistry laboratory. *Journal of Chemical Education*.

Kesner, L., & Eyring, E. (1999). Service-learning general chemistry: Lead-paint analyses. *Journal of Chemical Education,* 76(7), 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."

Langseth, M. (1996). From Shakespeare to chemistry: Service-learning and academic pursuits. *Thresholds in Education*, 22(2), 22-24.
http://www.servicelearning.org/library/lib_cat/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."

Lariviere, F. J., Miller, L. M., & Millard, J. T. (2007). Showing the true face of chemistry in a service learning outreach course. *Journal of Chemical Education*, 84(10), 1636-1639.

"We describe a service-learning course in which college students developed hands-on chemistry laboratory activities for elementary school children. These activities were then conducted with children both in area classrooms and in our own laboratories…."

Mebane, S. (2007). *Chemistry literacy project: Environmental justice action with education and research*. Paper presented at the annual meeting of the North American Association for Environmental Education, Virginia Beach, Virginia.

Strait, M., & Wiegand, D. (2000). What is service-learning? *Journal of Chemical Education*, 77(12), 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."

Sutheimer, S. (2008). Strategies to simplify service-learning efforts in chemistry. *Journal of Chemistry Education*, 85, 231.
"Service-learning is a powerful pedagogy in which community service is an integral part of classroom education. Including a service component in a chemistry course requires flexibility and creativity on the part of the instructor as well as the institution. This paper suggests some strategies that can make service-learning more feasible for chemistry programs, such as using short projects that may need as little as a single lab period."
<http://www.jce.divched.org/Journal/Issues/2008/Feb/abs231.html>

Wenzel, T. J. (2002). AC educator: Community-based projects in analytical chemistry courses. *Analytical Chemistry,* 74(9), 279 A-280.

V. Recommended Book Resources

Campus Compact. (1996). *Science and society: Redefining the relationship*. Washington, DC: Learn and Serve America and Education Commission of the States.
"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."
<http://www.servicelearning.org/library/lib_cat/index.php?library_id=489>

Cavinato, A.G. (2007). Service Learning in analytical chemistry: Extending the laboratory into the community. In P.A. Mabrouk (Ed.), *Active learning models from the analytical sciences*. (pp. 109-122). ACS Symposium Series 970.

Gardella, J.A., Milillo, T. M., Sinha, G., Gunwha, O., Manns, D. C., & Coffey, E. (2008). Linking advanced public service learning and community participation with environmental analytical chemistry: lessons from case studies in Western New York. In D. Redlawsk, & T. Rice. (Eds.), *Service learning with government partners*. Jossey Bass Publishers.

Hatcher-Skeers, M., and E. Aragon. (2002). Combining active learning with service-learning: A student

driven demonstration project. *Journal of Chemical Education,* 79(4), 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."

Kalivas, J.H. (2007). Progression of chemometrics in research supportive curricula. In P.A. Mabrouk (Ed.), *Active learning: Models from the analytical sciences: ACS Symposium Series 970*. Oxford University Press.

Kraft , R., & Kielsmeier, J. (1995). *Experiential learning in schools in higher education*. Boulder, CO: Association for Experiential Education.
http://www.servicelearning.org/library/lib_cat/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."

Mabrouk, P. A. (Ed.) (2007). *Active learning: Models from the analytical sciences*. American Chemical Society.

Ritter-Smith, K. (1998). When community enters the equation: Enhancing science, mathematics and engineering education through service-learning. Providence, RI: Campus Compact. <http://www.servicelearning.org/library/lib_cat/index.php?library_id=3446>

Vaughn, R. L., Seifer, S., Vye Mihalyuk, T. (2004). *Quick guide: Chemistry service-learning in higher education*. National Service Learning Clearninghouse.
"Service-learning in the chemistry curriculum provides an opportunity for students to learn while contributing to their communities. Examples of chemistry service-learning projects at the post-secondary level include: (1) teaching students about lead poisoning avoidance while assessing and analyzing lead content in the paint of older homes; (2) mentoring ?at-risk? students in chemistry;(3) leading hands-on science projects at middle and high-schools; and (4) monitoring environmental quality as a component of environmental improvement projects. Participation in service-learning experiences may help college students gain an understanding and appreciation of their role as scientists in society at large, while reinforcing core competencies in the chemistry curriculum. This publication provides a listing of web and print resources for practioners engaged in coordinating service learning opportunities in chemistry and science."
<http://www.servicelearning.org/instant_info/fact_sheets/he_facts/chem_he/>

Ward, H. (Ed.). (1999). *Acting locally: Concepts and models for service learning in environmental studies*. In E. Zlotkowski (Series Ed.), *AAHE's series on service-learning in the disciplines*. Washington, DC: American Association for Higher Education.
***Copy available in Alford Center for Service Learning's library.