

Cross-Disciplinary Resources for Scientists

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I. Leading Orgs./Grant Supporters & Ideas for S.L. Projects

1) National Science Foundation

<http://www.nsf.gov/>

The NSF has a multitude of funding programs designed to combine research with multigenerational education!

Check it out by simply searching “service learning” on the NSF funding site:

http://www.nsf.gov/funding/funding_results.jsp?queryText=service+learning&nsfOrgs=allorg&fundingType=0&pubStatus=ALL&pg=1&searchFunding=on

2) Science, Technology, Engineering, and Mathematics (STEM) Education Coalition

<http://www.stemedcoalition.org>

“The Science, Technology, Engineering, and Mathematics (STEM) Education Coalition works to support STEM programs for teachers and students at the U. S. Department of Education, the National Science Foundation, and other agencies that offer STEM related programs.

The STEM Education Coalition is composed of advocates from over 600 diverse groups representing all sectors of the technological workforce – from knowledge workers, to educators, to scientists, engineers, and technicians.”

One of the main goals to STEM is to support partnerships that will support engaging and effective education of all people in Science, Technology, Engineering, and Math: “Support new and innovative initiatives that encourage partnerships between state and local educators, colleges, universities, museums, science centers and the business, science, and technology communities that will improve STEM education.”

(The Coalition is co-chaired by the American Chemical Society and the National Science Teachers Association. Meetings are held monthly at the American Chemical Society, 1155 16th Street, NW, Washington, DC.)

***Also see a Fact Sheet that summarizes all of the STEM related sites:

http://www.servicelearning.org/instant_info/fact_sheets/he_facts/stem/

*****The Works:** An interactive science and art center in Newark, conducts STEM programs and would love more innovative ideas to engage Newark youth in science and art.

The Works is “ a place where visitors of all ages can explore the connections between art, technology and history. A place for lectures, gallery showings, concerts and science exhibits.”

*Please contact the Works at (740)349-9277

www.attheworks.org/

3) STEM Education Caucus

www.stemedcaucus.org

Maintained by the National Science Teachers Association, the STEM ED Caucus seeks to strengthen STEM education at all levels (K-12, higher education and workforce) by providing a forum for Congress and the science, education and business communities to discuss challenges, problems, and solutions related to STEM education. Includes links to related STEM resources and information.

4) CRS Report for Congress: Science, Technology, Engineering, and Mathematics (STEM) Education: Background, Federal Policy, and Legislative Action

<http://www.fas.org/sgp/crs/misc/RL33434.pdf>

This report provides the background and context to understand these legislative developments. The report first presents data on the state of STEM education in the United States. It then examines the federal role in promoting STEM education. The report concludes with a discussion of the legislative actions recently taken to address federal STEM education policy.

5) Merck/AAAS Undergraduate Science Research Program (USRP)

AAAS: Advancing Science, Serving Society

<http://php.aaas.org/programs/education/merck/>

“Since 1994 the Merck/AAAS Undergraduate Science Research Program (USRP) has awarded grants to support undergraduate interdisciplinary research in the sciences.”

“The Program’s support is provided by The Merck Company Foundation, which will have contributed over \$11,500,000 when the grant term ends in 2011.”

6) Center for Women in Science and Technology

<<http://www.wesleyancollege.edu/Academics/CentersofExcellence/CenterforWomeninScienceandTechnology/tabid/438/Default.aspx>>

This Center not only provides resources for Wesleyan women in mathematics, natural science, and technology but also promotes interest in science among young girls. The Center will be located in the new Munroe Science Center (scheduled to be open Fall 2007), although many of the outreach efforts are already established and successful--- including summer experiences for middle school girls on our campus (SPECTACLES camp) and regular classroom visits by Wesleyan science scholars to local elementary schools for help with hands on experiments (KISMET program).

The Center also sponsors visits by nationally known scientists, expanded pre-professional education, and summer continuing education programs for science and math teachers in our area.

7) International Science Shop Network

<http://www.scienceshops.org/index.php>

Science Shops are not “shops” in the traditional sense of the word. They are small entities that carry out scientific research in a wide range of disciplines – usually free of charge and – on behalf of citizens and local civil society. The fact that Science shops respond to civil society’s needs for expertise and knowledge is a key element that distinguish them from other knowledge transfer mechanisms. Science Shops are often, but not always, linked to universities, where students conduct the research as part of their curriculum.

II. Syllabi & Model Programs

1) Arizona State University

A) Example STEM Program at a University: The Math and Science Education Research Group @Arizona State University

Summary at: <http://mathed.asu.edu/about/index.shtml>

MSERG produces new knowledge to improve the education available to all students in science, mathematics, engineering and technology. Interdisciplinary research teams on our funded projects include faculty mathematicians, scientists, engineers and educators.

Our focus spans classrooms from K-12 through graduate studies. Our vision is for Arizona to lead the nation and the United States to lead the world in providing all students with an intellectually exciting, mind-building education in math and science—the kind of deep understanding that develops the critical thinking and problem-solving citizens must have to compete in a 21st century global economy.

B) Descriptions of all Service Learning Programs in the Sciences at ASU:

<http://cresmet.asu.edu/cgi-bin/outreach.pl>

C) Service Learning Program @ ASU:

<http://uc.asu.edu/servicelearning/index.php>

D) Descriptions of Service Learning Courses/Internship programs

<http://uc.asu.edu/servicelearning/descriptions.php>

E) Science is Fun K-8 Student Teachers @ Arizona State University

<http://uc.asu.edu/servicelearning/descriptions.php?cd=uni494a>

Science is Fun interns visit different Phoenix-area K-8 schools once per week throughout the semester. Teams of 2-3 interns explore exciting science experiences in the classroom with as many as 40 students at a time. For example, demonstrations include chilling a racquetball to sub-arctic temperatures in liquid nitrogen and shattering it or inflating a sealed balloon (by reducing the air pressure surrounding it). The goals are to provide valuable role models, spark interest in science, and encourage students to attend higher education.

2) Example Consortium for STEM Education (C-STEM) @ New Mexico State University

<http://stem.nmsu.edu/>

For many years, New Mexico State University has been a national leader for increasing the numbers of under-represented students including students with disabilities who have entered Science, Technology, Engineering, and Mathematics (STEM) programs at the community college, university and eventually entered the STEM working force.

The over 50 STEM education programs cover the pre-K- 20 pipeline of related educational and support systems for students interesting in learning more about science, technology, engineering and mathematics. These programs range from early childhood science, to summer and year-long programs for K-12 students, their teachers and families, to undergraduate educational and financial support including lab study opportunities, and through post-graduate programs in STEM research and higher education.

3) Columbia University's Science, Math, and Engineering Community Engagement

<http://neighbors.columbia.edu/pages/manplanning/community/education.html>

Manhattanville in West Harlem: Science and math outreach includes multiple programs and centers where undergraduate students work with K-12 community members, science teacher training in the

summers, engineering service learning projects where college students and high school students work together toward a specific goal.

For example, "Columbia's Double Discovery Center serves more than 1,000 students each year through its two youth education programs, Talent Search and Upward Bound."

4) 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."

5) InnoWorks

<http://www.innoworks.org/newinno/>

InnoWorks is a non-profit organization founded, developed, and conducted by volunteer college students, and is devoted to designing and implementing innovative programs guided by the latest neuroscience-based educational methodologies to stimulate interest in science, technology, and engineering among middle school students from disadvantaged backgrounds, with particular emphasis placed on targeting underrepresented minorities and females. Penn InnoWorks targets middle school students from three areas in the City of Philadelphia area - West, North and Chinatown. Penn InnoWorks will also provide bi-monthly scientific demonstrations at local middle schools.

6) 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.

7) Science and Teatre Magic Program (STMP) @ Villanova University

<http://www.csc.villanova.edu/~magic/>

Villanova University is proud to offer a unique multidisciplinary summer program for creative 13-17 year olds who love science and are interested in teaching and performing for younger kids from Philadelphia. Villanova faculty, staff, and students work alongside young scholars in university laboratories and special workshops, helping them create, plan, and perform in an all-American School of Magic.

8) Foster Family Center for Engineering Service Learning @ U of C

Summary of the Engineering Service Learning projects Carried out by each team in the course:

<https://eng.ucmerced.edu/slp/portal/teamsJournals>

In the 2007-2008 academic year, approximately 120 University of California Merced School of Engineering students are participating on 10 multidisciplinary teams. Each team of 8 to 10 students includes freshmen, sophomores, juniors, and seniors, and each team has a multi-year partnership with a community service or education organization. Projects are in four broad areas: human services, access and abilities, education and outreach, and the environment.

9) Yale Science for the Community: Programs for K-12 Students

http://www.yale.edu/onhsa/science/science_k-12.html

Yale University has a special commitment to education and New Haven's youth. The University makes its world-class laboratories, courses and talented faculty, students and staff available to encourage young scientists and engineers. Many of our programs are exploratory and inquiry-based, making them particularly engaging for students. We welcome new participants in our educational programs and encourage you to look at our featured events page for upcoming activities.

10) Science Service-Learning Project Ideas from the Pennsylvania Service-Learning Alliance

http://www.paservicelearning.org/Project_Ideas/Science.html Simple science service learning project ideas that work for any age group. These projects would be great opportunities for college students to lead service learning activities with local middle and high school students.

11) Power Point on Service Learning in Science and Technology @ Louisiana State University

Contains examples of possible projects as well as guidelines and outcomes of service learning.
<app1027.lsu.edu/ccell/Service-Learning%20in%20Science%20and%20Technology.ppt>

12) Lawrence Math & Science Partnership

<http://www.merrimack.edu/academics/EngagedLearning/ServiceLearning/Pages/LawrenceMathAndSciencePartnership.aspx>

Middle school students in Lawrence, Mass. are building their skills in science and math and receiving homework help from Merrimack College students through a Learn and Service program funded by the Corporation for National and Community Service (CNS).

13) Descriptions of Service Learning Courses Commonly Offered @ Carleton College

<http://apps.carleton.edu/collab/civic/courses/past/commonlyoffered/>

14) Concentration Program Specifically on Science in Society @ University of Texas Austin

<http://www.utexas.edu/cola/progs/sts/>

Science, Technology and Society is an interdisciplinary program in the College of Liberal Arts at the University of Texas at Austin. Our aim is to give students, faculty, and others in the community the opportunity to explore the wide ranges of social impacts of emerging technologies and new scientific discoveries, using the diverse approaches of the liberal arts, social sciences, and humanities. Digital information technologies, new communication technologies and new scientific innovations are rapidly transforming traditional ways of working, learning, and living. Key STS areas include Societal Impacts of Nanotechnology, Gaming, Education, Bio-health, Surveillance, Mobile Technologies, E-society and Computer-mediated communication.

15) Summary of the Study of Science and Technology in a Societal Context

http://en.wikipedia.org/wiki/Science_and_technology_studies

16) Comprehensive list of Service Learning Classes at LSU:

<https://ccelldb.lsu.edu/listclasses?page=1&session=FAL&year=2008>

Includes a lot of classes in science and math disciplines (biology, chemistry, math, environmental studies, etc.). Please contact the professors for more information.

17) The Science Alliance

<http://www.thesciencealliance.com/>

Outreach program where university students can teach chemistry, physics, and environmental studies to K-8th graders through fun activities.

18) Science in Service @ Stanford University

Science in Service is a unique collaboration of Stanford students, science and engineering faculty, service-learning educators, and Peninsula community organizations.

Science in Service connects Stanford students to youth in our neighboring communities through science mentorship and after-school science clubs, providing students a unique opportunity to learn about and participate in science outreach.

19) Bates College Service Learning in the Sciences

A) Math and Science Teacher-in-Residence

<http://www.bates.edu/x165548.xml>

Starting in 2006-2007, a grant from the Howard Hughes Medical Institute made it possible for Bates College to launch this program, which brings to Bates College a middle- or high-school math or science teacher for one year. The purposes of the program are two-fold: to provide mentoring and coursework to Bates students who wish to explore the possibility of precollege science or mathematics teaching; and to allow the teacher-in-residence to gain skills and knowledge through coursework and collaboration with Bates faculty that will transfer to his/her school.

B) In Depth Description of Academic Coursework in a Wide Variety of Disciplines

(contains a plethora of courses in the sciences and social sciences):

<http://www.bates.edu/Prebuilt/07-08YESElectronicFinal.pdf>

More than a third of our faculty has included a service component in its courses and more than half of the student body has engaged in a service-learning project. Faculty across all disciplines engage their students in service-learning. Approximately 70 current faculty members have incorporated service-learning into their courses.

20) Service Learning for Pre-Service Math Teachers @ CalState

www.calstate.edu/cce/resource_center/presentations/Math_Sci_Teachers_and_SL.doc

21) STEM Resource Sheet from Learn and Serve America's National Service-Learning Clearinghouse

[http://servicelearning.org/instant_info/fact_sheets/he_facts/stem/index.php?search_term=stem%20\(site:www.servicelearning.org%20|%20site:servicelearning.org%20|%20site:www.Servicelearning.org%20|%20site:Servicelearning.org%20\)](http://servicelearning.org/instant_info/fact_sheets/he_facts/stem/index.php?search_term=stem%20(site:www.servicelearning.org%20|%20site:servicelearning.org%20|%20site:www.Servicelearning.org%20|%20site:Servicelearning.org%20))

III. Community Based Research

1) Agency for Healthcare Research and Quality: “The Role of Community-Based Participatory Research” (U.S. Department of Health & Human Services)

<http://www.ahrq.gov/research/cbprrole.htm>

This site summarizes how community based research is different from traditional research in health-related fields. It also gives multiple examples of CBR from community member and researcher perspectives.

“In CBPR, community-based organizations (CBOs) or groups (such as churches, church members, neighborhood organizations, community residents, and other social organizations) help researchers to recruit subjects. But they do more than that. Community-based organizations play a direct role in the design and conduct of the research study by:

- 1) Bringing community members into the study as partners, not just subjects.
- 2) Using the knowledge of the community to understand health problems and to design activities to improve health care (interventions).
- 3) Connecting community members directly with how the research is done and what comes out of it.
- 4) Providing immediate benefits from the results of the research to the community that participated in the study”

2) Modeling Instruction Program

<http://modeling.asu.edu/>

Modeling instruction in the sciences at the University level “emphasizes active learning through a wide variety of short experiments (often computer-based), pencil-and paper exercises and discussion questions” (according to Dr. David Hestenes).

Though modeling instruction is not the same as service learning instruction; service learning instruction is similar in that it often incorporates a problem or project-based applied learning techniques.

Please see the page specifically on re-modeling University Physics:

http://modeling.asu.edu/rup_workshop/

Any Questions? Prof. Kathy Harper (Visiting Assistant Physics Professor; harperk@denison.edu) directs the Ohio workshops in Modeling Instruction. Please contact her with questions about up-coming workshops. Inquisitive visitors are always welcome.

3) National Center for Case Study Teaching in Science

Case study courses provide a prime jumping off point for service learning activities.

<http://ublib.buffalo.edu/libraries/projects/cases/case.html>

4) Undergraduate Research and Mentoring Program @ University of Wisconsin, Madison

3 year, rigorous interdisciplinary science research program to prepare students for graduate research.

<http://www.wisc.edu/cbe/urm/index.html>

IV. Recommended Books and Journal Articles

- Barton, A.C. (2000). Crafting multicultural science education with preservice teachers through service learning. *Journal of Curriculum Studies*, 32(6), 797-820.
- Service Learning's effects on Creating Multicultural Science Education with Pre-service Science education students. "In this paper, I explore community service-learning as one way of addressing the multicultural dimension of preservice education with the following three questions: In what ways does involving pre-service science teachers in community service-learning influence their views on multicultural science education, in theory and practice? What qualities of community service-learning make multicultural science education a realistic objective? How might service-learning be used to push our collective understanding of what an inclusive and liberatory multicultural science teaching practice could be? I explore these questions and propose further areas of research by using a case study involving service-learning from my own teaching-research with preservice students."
- **Find through Denison Library's on-line database: EBSCO

Campus Compact. *Science and society: Redefining the relationship*. Providence, RI: Campus Compact, 1996.

"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 course in the SEAMS (Science, Engineering, Architecture, Mathematics, Computer Science) disciplines at the high school and college levels."

<http://servicelearning.org/library/lib_cat/index.php?library_id=489>

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>

Goebel, C. A. (2008). Change over a service learning experience in science undergraduates' beliefs expressed about elementary school students' ability to learn science. Unpublished doctoral dissertation, Emory University.

<<https://etd.library.emory.edu/view/record/pid/emory:155pn>>

Gutstein, J., Smith, M., & Manahan, D. (2006). A service-learning model for science education outreach. *Journal of College Science Teaching*.

The Science Education Outreach Program (SEOP) engages undergraduate students from a variety of academic disciplines in service-learning experiences. University and community educators introduce and model contemporary educational theories and methods to participating undergraduates during weekly seminars. Concurrently, SEOP students apply these strategies through service-learning experiences in the context of science education in area schools and community-based programs. A comprehensive review of SEOP indicated that the undergraduates applied the seminar teachings to their outreach efforts, and that participation in

the program had positive impacts on their education and career choices, as well as workplace and life skills.

Handa, V., Tippins, D., Thomson, N., Bilbao, P., Morano, L., Hallar, B., & Miller, K. (2008).) A dialogue of life: Integrating service learning in a community-immersion model of preservice science-teacher preparation. *Journal of College Science Teaching*.

Dubbed a “dialogue of life,” community immersion in preservice science-teacher education aims at providing a true-to-life and empowering opportunity for prospective science teachers (both elementary and secondary) to become active participants in community life through field and service-learning experiences. It consists of a three-unit course with a field component wherein prospective science teachers live in a local community and immerse in the life-worlds of rural village people—their social, cultural, economic, and many other realities become the matrix for embedding science learning and activities.

< http://learningcenter.nsta.org/product_detail.aspx?id=10.2505/4/jcst08_037_06_14>

Journal of STEM Education

The Journal of STEM Education: Innovations and Research is a half yearly, peer-reviewed publication for educators in Science, Technology, Engineering, and Mathematics (STEM) education. The journal emphasizes real-world case studies that focus on issues that are relevant and important to STEM practitioners. These studies may showcase field research as well as secondary-sourced cases. The journal encourages case studies that cut across the different STEM areas and that cover non-technical issues such as finance, cost, management, risk, safety, etc. Case studies are typically framed around problems and issues facing a decision maker in an organization.

<<http://ojs.jstem.org/index.php?journal=JSTEM>>

Little, N. (1996). *Science service learning student manual*. Seattle, WA: University of Washington.

“A compendium of articles, project and program descriptions, curriculum descriptions, and contact information on the subject of science service learning. This manual is intended to provide the rationale of science service learning as well as detailed information to help integrate and replicate science service learning projects. (AT)”

<http://servicelearning.org/library/lib_cat/index.php?library_id=2939>

National Science Teachers’ Association (NSTA): Learning Center

Includes journal articles on service learning in a variety of scientific disciplines. You can get most journal articles for free if you are a NSTA member or for a dollar otherwise.

<<http://learningcenter.nsta.org/search.aspx?action=browse&text=service%20learning&price=0&product=0&subject=0&topic=0&gradelevel=college>>

Papalaskari, M.A., Hess, K., Kossman, D., Metzger, S., Phares, A., Styer, R., et al. (2006). PIVOTS: Service learning at the science, theatre & magic boundary. *Paper presented at the Annual Frontiers in Education Conference: 27-31* (pp. 18-23). IEEE.

- Rao, S., Shamah, D., & Collay, R. (2007). Meaningful involvement of science undergraduates in K-12 outreach. *Journal of College Science Teaching*.
The authors argue for the involvement of science undergraduates in K–12 outreach to enhance their communication skills, generate enthusiasm for science in today’s youth, and extend relationships between institutions of higher learning and surrounding communities. Here we present three opportunities created at Oregon State University for engaging science undergraduates in formal and informal K–12 instruction, and discuss the benefits to students and to the institution.
<http://learningcenter.nsta.org/product_detail.aspx?id=10.2505/4/jcst07_036_06_54>
- Ritter-Smith, K. *When community enters the equation: Enhancing science, mathematics, and engineering education through service-learning*. Providence, RI: Campus Compact, 1998.
The anthology includes the following essays related to service learning in the hard sciences: "Why Service-Learning? And How to Integrate it into a Course in Engineering," Edmund Tsang; "Enhancing our Courses: New Dimensions Through Service-Learning," (mathematics), Joan Kleinman; "Reflection in Science Courses: Is it Feasible?," (chemistry), Deborah Wiegand; "Professional Activism: Building Service-Learning, Reconnecting Community, Campus and Alumni Through Acts of Service," (civil engineering), Rand Decker; and "Forgiving Effective Service-Learning Partnerships via the Cascade Model," (biology and health education), Amal Abu-Shakra and Tun Kyaw Nyein.
<http://servicelearning.org/library/lib_cat/index.php?library_id=3446>
- Scott, A. K., Oliver, J. S., & Knauff, D. A. (2005). Service learning and science: A successful model. *Academic Exchange Quarterly*.
In this paper, a university based program which places science students in local elementary schools to serve as science experts for teachers is described. Both informal and formal evaluation has shown the program to be highly successful for partner teachers and participating students. The model on which it is based should be highly transportable and robust to the individual needs of schools and universities who seek to employ it.
<http://findarticles.com/p/articles/mi_hb3325/is_ai_n29182848>
- Varelas, M., Plotnick, R., Wink, D., Fan, Q., & Harris, Y. (2008). Inquiry and connections in integrated science content courses for elementary education majors. *Journal of College Science Teaching*.
An interdisciplinary team of science and education faculty at the University of Illinois at Chicago and several Chicago-area community colleges developed and implemented a series of four integrated, inquiry-based science courses for pre-service elementary school teachers. All four courses are based on guiding principles taken from the rich literature on constructivist teaching and learning of science developed in recent decades. Further, their content and pedagogy align with national and state standards (National Academy of Sciences 1997; NRC 1996, 1997). This article describes each course and elaborates on a particular principle, sharing representative examples of how this principle is enacted in that course.
<http://learningcenter.nsta.org/product_detail.aspx?id=10.2505/4/jcst08_037_05_40>