



Image created by Colleen Simon for [opensource.com](http://opensource.com)



# Strengthening STEM Education Through Service-Learning



Highlights from the  
2010 Learn and Serve America  
Higher Education STEM Grants

# Strengthening STEM Education Through Service-Learning

Highlights from the 2010 Learn and Serve America Higher Education STEM Grants



*The purpose of the Corporation for National and Community Service Learn and Serve America (LSA) Higher Education program was to support institutions of higher education that use innovative service-learning programming to meet the needs of local communities. For its 2010 grant competition, LSA identified service-learning in science, technology, engineering, and mathematics (STEM) academic disciplines as one of two program priorities. This work highlights the work of 13 grantees from across the country funded under that priority.*

## SERVICE-LEARNING AND STEM

---

### Why STEM?

"The paradox is that we live in a society where a lot of the careers that can be launched with a solid education in the STEM curriculum would seem to be appealing to the students who are failing to learn about them."

- Greg Tucker<sup>1</sup>

The demand for high-quality STEM education has been publicized in several reports that link the nation's future economic success and security to a highly skilled STEM workforce. Here is a brief snapshot of the evidence. There is a projected shortage of 3 million workers with U.S. college degrees in STEM fields (associates or higher), by 2018.<sup>2</sup> According to the U.S. Department of Commerce:

Science, technology, engineering and mathematics (STEM) workers drive our nation's innovation and competitiveness by generating new ideas, new companies and new industries. However, U.S. businesses frequently voice concerns over the supply and availability of STEM workers. Over the past 10 years, growth in STEM jobs was three times as fast as growth in non-STEM jobs. STEM workers are also less likely to experience joblessness than their non-STEM counterparts. Science, technology, engineering and

mathematics workers play a key role in the sustained growth and stability of the U.S. economy, and are a critical component to helping the U.S. win the future.

- In 2010, there were 7.6 million STEM workers in the United States, representing about 1 in 18 workers.
- STEM occupations are projected to grow by 17.0 percent from 2008 to 2018, compared to 9.8 percent growth for non-STEM occupations.
- STEM workers command higher wages, earning 26 percent more than their non-STEM counterparts.
- More than two-thirds of STEM workers have at least a college degree, compared to less than one-third of non-STEM workers.
- STEM degree holders enjoy higher earnings, regardless of whether they work in STEM or non-STEM occupations.<sup>3</sup>

To increase the nation's global economic competitiveness and improve employment prospects for more Americans, the Obama administration initiated a concentrated effort to align federal investments, including these LSA grants.<sup>4</sup>

### **Why Service-Learning?**

"I hear and I forget. I see and I remember. I do and I understand."  
- Confucius<sup>5</sup>

Statistics from the National Math and Science Initiative suggest that fresh approaches to STEM education are necessary in order to address the disconnect in workforce development. Twenty-five years ago, the U.S. led the world in high school and college graduation rates. Today, the U.S. has dropped to 20th and 16th. Moreover, despite the value of STEM education:

- 45 percent of 2011 U.S. high school graduates are ready for college-level math.
- 30 percent of 2011 U.S. high school students are ready for college-level science.
- 38 percent of students who start with a STEM major do not graduate with one.

- U.S. students recently finished 25th in math and 17th in science in the world compared to 31 other countries.
- The prestigious World Economic Forum ranks the U.S. as No. 48 in quality of math and science education.<sup>6</sup>

There is a substantial body of published evidence that service-learning, a teaching and learning strategy that integrates meaningful community service with instruction and reflection, provides students opportunities to apply knowledge in practical situations and develop skills from the experience of connecting theory with practice. Service-learning has also been linked to increases in social self-confidence in students, as well as an increased ability to assume personal responsibility and the development of valuable workplace skills and habits. These are all outcomes that educators believe can help retain students in STEM fields as they give students glimpses of themselves as STEM professionals. A fuller exploration of evidence regarding service-learning is available at the National Service-Learning Clearinghouse.<sup>7</sup>

A recent survey by Intel and Change the Equation also found that teenagers' interest in pursuing engineering increases dramatically when they hear about the ways it might benefit the world. Although 63 percent of teens have never considered a career in engineering, the societal benefits of what engineers do, like preventing disasters or generating cleaner electricity, are particularly resonant with teens that have never considered engineering before. Learning about engineering feats such as saving the Chilean miners who were trapped for 69 days motivates 52 percent to think twice about the career.<sup>8</sup> Service-learning offers students of all ages the opportunity to experience how STEM skills and knowledge could benefit communities as well as themselves.

A growing number of organizations have developed effective methods to integrate service-learning of various types into STEM curricula. These include groups like Community-Campus Partnerships for Health<sup>9</sup>, EPICS: Engineering Projects in Community Service<sup>10</sup>, and Science Education for New Civic Engagements and Responsibilities (SENCER).<sup>11</sup>

Other organizations are contributing to the knowledge base regarding service-learning in STEM as well. The Science Education Research Center at Carleton College<sup>12</sup> and Campus Compact<sup>13</sup> also list extensive examples of case studies, syllabi, and project assessments from successful service-learning courses in STEM fields.

The higher education grantees in the 2010 round of LSA funding engaged in projects that supported the integration of high-quality service-learning into

STEM disciplines as a strategy to provide real-world context for classroom content. STEM and service-learning in many ways was a logical next step for a focus area. The issues addressed by this set of grantees aligned well with the most common challenges addressed by LSA historically: improving education (41 percent), preserving the environment (28 percent), and promoting economic development (27 percent).<sup>14</sup>

Grantee projects generally fell into two categories, with many projects addressing both types: 1) STEM aspiration in K-12 students and STEM career development through higher education, and 2) issue-based explorations of applied work in STEM disciplines, including environmental sustainability, food security and sustainability, and health.

## **PROGRAM SUMMARIES OF FUNDED PROJECTS**

---

In June 2010, thirteen grants were awarded. These included grants to support work at individual campuses (Burlington County College, College of the Canyons, Delgado Community College, Donnelly College, El Paso Community College, Northwest Indian College, University of California, Santa Cruz, and University of Southern Mississippi), as well as grants to statewide organizations (California State University Chancellor's Office, Florida Campus Compact, Hawaii and Pacific Islands Campus Compact) and two multi-state consortiums (Washington Campus Compact with Oregon Campus Compact and Idaho partner campuses, and Wisconsin Campus Compact with the Compacts in Iowa, Illinois, Michigan, Minnesota, and Kansas).

The descriptions below reflect the initial three-year plans and goals of each grantee. When LSA funding was eliminated in the 2011 federal budget, each project renegotiated its grant contract and adjusted projects goals and activities. Despite the loss of the second two years of funding, many grantees maintained a three-year commitment to their projects. As evident in the *Closer Look* profiles below, many grantees found that their service-learning strategies were so well-received that they came close to, or in some cases met their three-year goals in the first year.

## **Burlington County College**

Burlington County College's BurServe Service-Learning program will create a culture of service by engaging middle and high school students in projects such as energy conservation and weatherization. This project will build off existing partnerships with AmeriCorps, 21st Century Community Learning Centers, and NASA STEM. BurServe will help school districts, communities, and homeowners reduce energy consumption through instruction in and establishment of energy efficiency measures. Over the grant period service-learning will be incorporated into courses by 30 of their 57 faculty over three years.

## **California State University, Chancellor's Office**

The California State University (CSU) system, which has a service-learning center at each of its 23 campuses, will expand service-learning courses in STEM disciplines by (1) supporting innovative programs on five campuses; (2) providing specialized and dynamic training for faculty across all CSU campuses to integrate service learning in the STEM disciplines; and (3) by offering sub-grants to STEM departments to build service learning into their academic programs. In addition, the CSU will replicate a successful "STEM student success" program at CSU San Bernardino (CSUSB). CSUSB's Coyote Careers program connects students to STEM fields through tutoring in hard-to-pass courses, and providing service-learning and internship experiences, mentoring, and career counseling.

## **College of the Canyons**

College of the Canyons will address the need to improve elementary science for Santa Clarita Valley 5th grade students by providing them with outside of the classroom learning in addition to standard in-school teaching. The Elementary Science Education service-learning program will collaborate with local school districts to provide college students with the resources to create and use science kits to teach students through hands-on discovery. The curriculum will be developed to target science majors enrolled in the Math, Engineering, Science Achievement (MESA) program, which is designed to help underrepresented, educationally and economically disadvantaged students transfer to a four-year colleges and universities. High school students will be given opportunities to explore science in a way that will encourage them to pursue the sciences in college and, to ultimately encourage careers in science and math.

## **Delgado Community College**

Delgado Community College seeks to provide increased access to health care to the residents of New Orleans by creating the innovative Community Care Initiative (CCI) that will restructure the college's Allied Health program clinical rotation format so that all students provide services and education to low-income and uninsured residents, instilling and fostering an awareness of and commitment to service in high-need communities. CCI will provide an effective service-learning experience for future health care practitioners while providing an opportunity for these students to engage in direct patient care through identified partner agencies. The program will also raise awareness among this high-need population of the value of a "medical home." The Community Care Initiative will engage students working towards professions in healthcare practice in over 10,000 hours of service over the course of the three-year grant period.

## **Donnelly College**

The Donnelly College ACTS (And Community Together in Service) program incorporates service-learning in the STEM disciplines of mathematics, healthcare and science, to increase student achievement throughout the college. The Donnelly program is built on a foundation of existing partnerships with local leaders in the STEM field that have created long-term reciprocal relationships between the college and its local community partners. Donnelly College students will tutor local middle and high school students in STEM disciplines, and will design middle school science curricula that will be used when the students are brought on campus to promote college awareness. Donnelly ACTS will bring together local leaders, college students, and middle-school students to demonstrate the power that service-learning can have to increase achievement, interest in STEM majors and careers, and capacity to serve the local community.

## **El Paso Community College**

El Paso Community College will implement the "Protect Our Water and Environmental Resources" (POWER) program to contribute to the environmental sustainability in the U.S.-Mexico border region. This project intentionally pairs faculty with underrepresented Hispanic and female science studies students. Together they will work with community partners focused on environmental awareness and stewardship in the El Paso area, specifically in Keystone Heritage Park, International Boundary & Water Commission and El Paso Zoo. These students will integrate service-learning in the sciences as a strategy to increase academic outcomes in higher education. Over the three-year grant period the POWER program will teach over 900 students and engage 30 STEM faculty members.

## **Florida Campus Compact**

Florida State University/Florida Campus Compact plans to train faculty at a series of service-learning institutes and then subsequently provide service-learning grants for institute participants. These institutes will train, support, and equip faculty members to modify and develop STEM courses and to integrate service-learning into the curriculum. These institutes will increase the quantity and quality of service-learning instruction in the sciences as well as encourage changes in behavior that will create a more sustainable future in terms of environmental integrity, economic viability, healthy communities, and a just society for present and future generations. Institute participants will work with community partners to address recognized long-term community needs with an emphasis on localized environmental and community health issues. Over the three-year grant period, 500 faculty members will create over 300 new STEM courses that integrate service-learning into 20 colleges and universities, ultimately engaging 6,000 college students.

## **Northwest Indian College**

The Northwest Indian College's Center for Indigenous Service-Learning will implement three year-long service-learning projects that addresses topics in the science, technology, engineering, and mathematics (STEM) fields. One project will promote healthy food behaviors and tribal food sovereignty by installing and maintaining perennial native plant gardens that include fruit and nut trees and other edible plants at both their Lummi and Swinomish campuses. Students will also distribute harvested senior center lunch programs in each community. A second project will increase environmental awareness within the Lummi community by assisting with the habitat restoration project of Smuggler's Slough, an important wetland habitat for juvenile salmon. A third project will partner with the Nez Perce Water Resources Department to develop a recycling project and an environmental education program for adults and elementary school students.

## **University California, Santa Cruz**

The University of California, Santa Cruz, in partnership with the City and County of Santa Cruz, will develop a science, technology, engineering and math (STEM) service-learning program (IDEASS) that will bring together students and faculty with local government and community professionals to develop technology-based solutions for reducing greenhouse gas emissions in the community. There are three major components of the program. The first is the development of numerous long-duration (30 to 45+ week-long) senior design projects that bridge social sciences and engineering. The second is the development of a



“Sustainability Clinic” devoted to STEM-based service-learning. The third is a project clearinghouse that will disseminate the results of the projects and act as corporate memory to ensure the continuity of service-learning projects. The projects will engage 120 college students, 30 university staff, and 20 faculty members over the grant period.

### **University of Hawaii at Manoa/HIPCC**

The University of Hawaii at Manoa and the Hawaii and Pacific Islands Campus Compact partnership has been leading the development of STEM career and academic pathways to deepen student’s understanding of environmental, energy, and health challenges, and science, engineering, and technology opportunities so they can redesign their communities and their futures. This program will have high school seniors and college students participating in cumulative courses and readiness training in STEM disciplines. Through faculty training, research, analysis, and service-learning coursework and initiatives, the Pacific Islands will make progress toward environmental sustainability. Over the course of the three-year grant period, 300 college students and an additional 1,000 high school students will work with 50 community partners across 5 islands to increase realize this goal.

### **University of Southern Mississippi**

The Mississippi Service Learning Program (MSSLP) will broaden service-learning and civic engagement across partner campuses and throughout the state. Through a STEM service-learning initiative, the program will create a network of colleges, K-12 schools, and community-based organizations that address local needs through service-learning in the STEM disciplines, provide professional development training for faculty, and develop college student leaders through the LeaderShape program. With a special focus on African American students and students with disabilities, MSSLP will teach 1,080 college students and create 39 courses over the course of the grant period.

### **Washington Campus Compact/with Oregon Campus Compact and Idaho campus partners**

The Washington Campus Compact will create the Northwest Sustainability Initiative (NWSI) to restore natural habitats and to increase green energy practices. Over three years NWSI will teach and coordinate the service of 1,530 disadvantaged youth, 5,760 college students and 240 faculty through 81 habitat restoration and 54 green energy service- learning projects. These students and teachers will incorporate K-12 tutoring/mentoring in natural resources, watershed restoration and green energy demonstration projects to address the

environmental needs of the community. Faculty will establish regional Faculty Fellows program to assess and evaluate the program, and broaden its reach to ensure continued sustainability. The various elements of this project will demonstrate how service-learning projects can have dynamic impacts on the environment.

### **Wisconsin Campus Compact/Midwest Campus Compact Consortium**

Wisconsin Campus Compact will address community problems such as hunger and provide health training, and nutrition education through a science, technology, engineering and math (STEM) focused service-learning initiative. University of Wisconsin-Extension has partnered with the Midwest Campus Compact Consortium members (Illinois, Iowa, Kansas, Michigan, Minnesota, and Wisconsin) and the Science Education for New Civic Engagement and Responsibilities (SENCER) to provide funds to solve local issues, educate students, engage faculty and increase student interest in STEM disciplines. Communities across five Midwest states will show an improvement in indicators of food security and/or social determinants of healthy nutrition and serve as a national hub for dissemination of best practice.



Delgado Community College Microbiology students led “science day” activities with pre-K through 4th graders as part of the campus Community Care Initiative (Photo: Delgado Community College)<sup>15</sup>

## **A CLOSER LOOK: FIVE PROJECT PROFILES**

The following LSA-funded projects were selected to represent the variety of grantees and program foci. Information for these profiles comes from LSA reports, project websites and correspondence with project staff.

## **BURLINGTON COUNTY COLLEGE**

**More than 400 students participated in service-learning**

**22 professors offered 35 service-learning class sections**

**Students served 3,000 hours in one semester**

**Over 400 community members attended service-learning activities**

Burlington County College (BCC) is a community college located in Burlington County, New Jersey, with an enrollment of approximately 7,500 students. The college offers both Associate degrees and certificate programs. The school has an established service-learning office and works with a wide variety of strong community partners.

The LSA grant certainly had the effect of energizing service-learning activity at BCC. The project surpassed the vast majority of its three-year goals in just one semester. Examples of individual projects undertaken as part of their courses include:

- Dental hygiene students provided over \$60,000 worth of free dental care and supplies to underprivileged children and the homeless population.
- Biology students participated in an environmental clean-up that allowed Brendan T. Byrne State Forest to reopen its campgrounds to community residents.
- Anatomy and physiology students volunteered at an American Red Cross donor center that collects the blood supply for more than 100 New Jersey and southeastern Pennsylvania hospitals.
- Environmental sustainability students developed educational displays for an “Energize the Community Day” at a local home improvement store. At the same event, donations were collected for Habitat for Humanity and free weatherization services were promoted by the Burlington County Community Action Program. Statistics students participated by collecting and analyzing pertinent data from the event. The event focused to educate attendees how to save on energy costs at home and to connect them with relevant, supportive services.<sup>16</sup>
- Physical science, math, education, and psychology students organized and hosted hands-on, educational workshops in local, grant-funded elementary school afterschool programs to encourage disadvantaged children to become interested in the STEM disciplines.

- Graphic design and English students assisted middle school students in the production of field guides to be utilized and distributed by local nature and environmental organizations.
- Computer technology students held a series of “Bridging the Digital Divide” seminars to help senior citizens become more familiar with basic computer skills.



**A BCC student applying his education at Energize the Community Day**

BCC students completed post-project surveys that indicated that students seemed to place significant value on their service-learning experience. Ninety-three percent of students indicated that they enjoyed participating in the service-learning activity, and over two-thirds indicated they would welcome service-learning leadership opportunities. Nearly 90 percent indicated that they believe they made a difference by participating in the service-learning activity.

The results regarding student persistence in STEM programs and career path recognition were also promising. Seventy-nine percent of students indicated they were likely to enroll in another science, math, or technology course. Two-thirds indicated that the service-learning activity had provided a valuable experience for their résumé.

It is also worth noting that a few of these projects involved service-learning students in multiple disciplines, potentially exposing those not enrolled in STEM courses to the contributions and careers that could be made by people in those fields.

## **CALIFORNIA STATE UNIVERSITY SYSTEM**

**Over 7,800 K-12 students participated in activities to spark interest in STEM**

**18 CSU faculty participated in Engaged Department Institute for Sciences**

**100% of those faculty reported increased ability to use service-learning**

**STEM service-learning courses offered annually increased from 284 to 463**

**Enrollment in STEM service-learning courses grew from 5,750 to 7,848**

The California State University (CSU) is comprised of 23 campuses enrolling 436,000 students with 44,000 faculty members and staff, making it the largest university system in the United States.<sup>17</sup> Coordinated by dedicated service-learning staff in the Chancellor's Office, CSU's (STEM)<sup>2</sup> project offered a wide variety of professional development opportunities for faculty across the system.

Products created through (STEM)<sup>2</sup> that will help inform future practice include a self-assessment rubric for the institutionalization of service-learning in university STEM departments and evaluation reports from engaged department institutes for STEM faculty. These are available on the project website.<sup>18</sup>

(STEM)<sup>2</sup> sub-granting activities intended to simultaneously expand service-learning experiences for CSU students while advancing their retention, graduation and career placement in the STEM disciplines included:

- Innovation sub-grants to carry out groundbreaking projects and serve as demonstration sites for replication throughout the CSU system.
- Laying the Foundation grants to 15 service-learning offices on CSU campuses to assess current STEM service-learning activities and promote service-learning outreach in STEM departments.
- Development of a how-to manual for STEM student success by a team at CSU San Bernardino, based on their award-winning CoyoteCareers program, which includes facilitation of career soft skills, service-learning internships, tutoring support, and alumni mentoring.<sup>19</sup>

Innovation grant project highlights:

- CSU Chico supported the development of materials and activities for a partnership between the Geological and Environmental Sciences department and the Chico Gateway Science Museum. Students developed 15 presentations at the museum on such topics as monitoring earthquakes,

demonstrations of volcanic eruption styles, and introduction to local geologic phenomena.

- CSU Fresno evaluated the effectiveness and sustainability of three STEM service-learning course models. Two courses in chemistry and physics used the tutoring model, and another physics course had students using a planetarium docent model. Students enrolled in the tutoring courses provided tutoring to both local high school students and Fresno State physics and chemistry students.<sup>20</sup>
- CSU Monterey Bay initiated a STEM Faculty/Community Partner Learning Community, which developed a Service-learning Course Development Workbook to outline upper division learning outcomes.
- CSU San Marcos created service-learning opportunities for students by offering mini-grants to STEM faculty. The project also created and distributed a service-learning brochure developed by physics faculty and community service staff, which outlined the connection between service-learning and STEM disciplines.
- Sonoma State University supported the Sustainable Waterways Educational Engagement Program with the primary purpose to embed service-learning, emphasizing sustainability of a local creek. They also converted the Campus Community Garden (adjacent to the creek) into an on-campus "laboratory" for biological pest control and watershed contamination analysis. Seven new service-learning courses were developed and agreements were established for data collection and restoration of the creek.



Fresno State students build an erosion control system in an earth and environmental sciences course.

image: (STEM)2 <http://www.calstate.edu/cce/stem/>

## **FLORIDA CAMPUS COMPACT**

**565 Florida higher education faculty were trained**

**Over 5500 college students were engaged in STEM service-learning**

**Over 100 service-learning courses were created**

**Increased capacity for 190 community partners**

The Florida Campus Compact STEM Initiative focused on working with faculty and staff at their member institutions to provide professional development that increased students' participation in STEM service-learning courses.

Those activities were intended to advance three larger goals:

1. Contribute to the development of a knowledge economy in Florida that is comprised of active, knowledgeable and engaged citizens/STEM professionals.
2. Encourage changes in behavior that will create a more sustainable future in terms of environmental integrity, economic viability, healthy communities, and a just society for present and future generations.
3. Institutionalize service-learning into the STEM disciplines.

Through a series of STEM Institutes and the STEM Fellows Program, faculty members were provided resources and training to provide student experiences that addressed local issues. More than 25 STEM Fellows representing approximately 20 academic disciplines engaged in multiple in-person and online professional development sessions. They were awarded a small stipend for completion of the program, which included an expectation to re-design courses. A collection of service-learning course syllabi developed by these Fellows is available online.<sup>21</sup>

Key stakeholders—faculty, community partners, and students—all found value in the project. Eighty-nine percent of the community partners surveyed reported that service-learners increased their capacity to meet specific community needs. One participating faculty member reflected on several other positive results of service-learning:

I found this to be an extremely gratifying class on a professional and a personal level. One of the things I noticed was increased retention, which has persisted through both of my spring courses. In addition, my class sizes have doubled and it appears students are signing up for the class to be involved in service-learning. Finally, I noticed a

completely different rapport develops with students in these courses. Students feel very comfortable talking to me both in the classroom and outside of class and they seem to think it is "cool" that I serve next to them at our service site.

In response to evaluation surveys, students themselves also noted beneficial effects:

- 86 percent reported an increased interest in the STEM disciplines
- 86 percent reported an increased awareness of their role as a citizen
- 82 percent reported that they feel better prepared for their career as a result of the service-learning



Image: Angel Rodriguez <http://prezi.com/inym65jmv0vv/>



## **WASHINGTON CAMPUS COMPACT**

**7,007 volunteers & service-learners served a total of 184,394 hours**

**193 faculty trained and 72 new service-learning courses**

**898 community organizations involved in partnerships**

**1,010 disadvantaged youth engaged**

The Northwest Sustainability Initiative (NWSI) is a program of Washington Campus Compact (WACC) in partnership with Oregon Campus Compact and campuses in Idaho, focused on five primary goals:

1. Increase college student engagement in service-learning within the STEM disciplines.
2. Institutionalize service-learning within the STEM disciplines.
3. Improve campus/community sustainability.
4. Increase green energy practices and restore habitats.
5. Engage disadvantaged youth in service-learning activities.

The NWSI project developed faculty leadership by creating a Faculty Fellows program. The eight Fellows explored how service-learning can be used to address one of three identified community needs: mitigation of nonpoint source pollution, habitat restoration/wildlife abundance, and green energy. Faculty Fellows were responsible for leading service-learning initiatives on their campuses, as well as designing and implementing workshops for additional campuses to broaden the institutionalization of service-learning within STEM disciplines.

The project also awarded sub-grants, which funded a variety of related student engagement efforts:

- Washington State University increased participation in Eco Adventures, a collaboration between the Center for Civic Engagement and University Recreation that links recreational programming with ecologically positive action.
- Everett Community College developed projects around waste management and composting, gardening, habitat restoration, and wind farm design.
- Whatcom Community College completed a campus waste audit in the spring of 2011, to establish a scientifically generated baseline of waste stream data for their campus in an effort to move towards zero waste and a more sustainable campus. A campus sustainability committee focuses on

facilities operations, analyzes the data collected and put together an awareness plan to better assist the student body and faculty in the area of recycling and landfill contribution.

- Lewis & Clark College students participated in an alternative spring break project doing habitat restoration with the Idaho Department of Fish and Game. To prevent erosion and provide food for native animals in an area damaged by a wildfire, these student volunteers assisted Fish and Game with planting nearly 14,000 trees and plants.
- Portland State University service-learning activities focused on monitoring over 50 stream sites, many which have associated restoration projects or potential restoration projects.
- The University of Oregon's efforts focused on the Sustainable City Year academic service-learning program, with more than 200 students in 13 academic courses contributing 38,000 hours to nine different projects in partnership with the City of Salem. Students delivered recommendations for affordable housing, on-site storm water treatment, and sustainable downtown development.

Additional details regarding the NWSI are available on the project website.<sup>22</sup>



**Evergreen State College students and volunteers**

## **WISCONSIN CAMPUS COMPACT/MIDWEST CONSORTIUM**

**950 service-learners in courses across five states**

**49 community organizations engaged in service-learning partnerships**

**441 youth mentored, 757 youth tutored**

**10,531 hours of service related to food issues**

A Midwest Consortium of Campus Compacts in six states (Illinois, Iowa, Kansas, Michigan, Minnesota, and Wisconsin) supported service-learning in STEM disciplines through the lens of food. Issues like food security, the social and physiological determinants of health, and sustainability enabled a wide array of projects that addressed local priorities and allowed students to gain hands-on learning experiences.

The project was also distinctive in requiring the higher education institutions receiving subgrants to partner with other colleges or universities in support of their community partners' goals. Highlights from four of the eleven subgrantee projects show some commonalities, which were also shared across projects at a SENCER institute early in the grant period and a workshop on service-learning and food sustainability toward the end.

- DePaul University and Chicago State University partnered with Eden Place Nature Center, which is just west of the Dan Ryan Expressway in the heart of Chicago. Students worked with community members to do projects including soil analysis, experiment with plant types, convert old windows into greenhouses. They also mapped local food access and community gardens. This work is part of a broader commitment by DePaul. According to Howard Rosing, director of DePaul's Steans Center, "the idea is to create a community food systems initiative that channels projects from various disciplines—everything from environmental science to commerce and computer science to the law school."<sup>23</sup>
- Madonna University and Schoolcraft College partnered with the City of Livonia (MI) and Livonia Public Schools on the *Growing Green Community Teaching Garden*. Over 300 college students participated in 14 STEM courses utilizing the garden for service-learning. A total of 1,617 K-12 students and 58 K-12 teachers participated in nutrition education presentations, and a *Garden Research Day* featuring student research presentations attracted over 100 community attendees.
- University of Wisconsin-Parkside and Gateway Technical College worked with UW-Extension and the Racine/Kenosha Community Action Agency

to engage science students in community food production and nutrition education. The project, "Cultivating Community, One Seed at a Time," engaged more than 230 students in community-based learning courses working on supporting community gardens or assisting nutrition educators in providing low-income and other individuals with information about healthy nutrition options and food preparation.<sup>24</sup>

- St. Olaf College, Carleton College, and St. Dominic and Greenvale Park elementary schools created the Food and Nutrition Service-learning Collaborative. A total of 240 college students from nine courses were involved in a variety of activities including school garden development, nutrition education, and farm field trips. The project created many new connections across educational institutions and community organizations. The learning benefits were also apparent in the words of one participating college student: "It helped me to have to synthesize the information that we learned in class and be able to recreate it for a 3rd and 5th grade level." A video of Greenvale Park's nutrition project is also available online.<sup>25</sup>



**Students at St. Dominic School in Northfield, MN planting a garden**  
Image: Mary Schier <http://northfield.patch.com/>

In addition to tracking local project outcomes, the Midwest Consortium conducted a standard assessment of learning outcomes across the participating institutions and states. Service-learners in subgrantees' STEM courses were surveyed in an effort to better understand the extent to which service-learning supported goals around increasing enrollment and retention of students in STEM fields. Over 85 percent of the service-learning students responded to a post-course survey:

- 63 percent of respondents identified themselves as female, a number higher than typical STEM course enrollment.
- While 45 percent of the respondents had not taken a previous college STEM course, their interest in STEM subjects at the end of their service-learning course was fairly high: 7.43 average on a 10-point scale.
- 72 percent of the students reported that the use of service-learning had enhanced their understanding of the scientific elements of the course.

Although the shortened project term limited the assessment to just one year of data, these preliminary numbers are encouraging to anyone interested in service-learning as a strategy for enhancing STEM education.

## **LESSONS LEARNED**

### **Ongoing Challenges**

Based on challenges reported by the 2010 LSA Higher Education STEM subgrantees, it appears as though many of the issues that are barriers to effective service-learning in general also apply to incorporating it in STEM disciplines. Despite the best efforts of service-learning staff and colleagues who can share their experiences and results with service-learning, as well as relevant research findings, many faculty continue to be concerned that incorporating service-learning into the curriculum will diminish the academic content covered in the course. In many STEM departments, the perception that service-learning lacks rigor or quantitative evidence persists.

Faculty are also wary of being responsible for assessing student learning that may or may not take place while the student is outside the classroom, without their supervision. Some express concern that administrative functions that arise with service-learning, such as risk management and transportation, keep them from tasks that they feel are more important to their ability to teach effectively.

Policies on review, tenure and promotion present significant barriers as well. Many grantees spoke of “buy-in” issues with faculty based on their sense that service-learning was not valued or even recognized by the people with power to make decisions regarding their professional advancement. Even when policies change to allow for or even actively support service-learning, departmental and institutional cultures may be slower to change.

Common hurdles related to alignment between community and academic calendars and the capacity of community partners to supervise a sudden influx of

short-term volunteers were identified by multiple grantees. This again serves as a reminder that most of the barriers to increasing STEM service-learning are not STEM-specific problems.

As campuses continue developing strategies to organize service-learning in ways that optimize results for both students and communities—and address faculty concerns—service-learning should increase in STEM disciplines as well as others. Where LSA funding incentivized faculty use of service-learning by providing course development grants, the disappearance of that resource and cutbacks in some colleges' and universities' budgets suggest that approach may not be sustainable. Faculty who initially receive such grants may well go on to develop subsequent service-learning courses without external funding. Yet greater focus needs to be placed on the interests that pedagogy can ultimately serve, whether a faculty member's personal passion about a particular public issue, an existing relationship with or request from a community partner, or improved student learning, engagement, and motivation. Advocates may also draw on the growing science education literature that, while not using the term service-learning, demonstrates the effectiveness of active, collaborative, experiential teaching methods and offers examples STEM faculty may find more persuasive.

### **Encouraging Outcomes**

Through this round of LSA higher education grants, well over a thousand short-term service-learning projects raised the profile of STEM education in K-12 schools, colleges and communities across the country. These projects have contributed to a greater understanding of and community action on critical issues such as energy consumption, water quality, and food security—issues that affect all people's daily lives.

Projects also aimed for some longer-term impacts. Although the shortened project timelines limited grantees' ability to support programming and track results over the expected three years, some interesting anecdotal themes emerged from the work they were able to do.

A frequent result was the emergence of unanticipated interdisciplinary projects between STEM and non-STEM departments working with the same community partner or on the same community issue. Service-learning in STEM disciplines that included outreach into K-12 schools often did so alongside other departments from their institution. Issue-centered projects often connected the social sciences and arts with scientific inquiry. If students experience science, technology, engineering, and mathematics not as elitist, inaccessible, difficult, or

somehow removed from most people's everyday reality and quality of life, they may more easily imagine themselves in a STEM career.

Many of the students involved in service-learning projects expressed an appreciation for the experience of applied, problem-based, real-world learning. In surveys conducted by the Midwest Campus Compact Consortium, nearly three-quarters of participating students agreed that the use of service-learning enhanced their understanding of the scientific elements of the course, and their interest in additional STEM courses was heightened.

In many instances, students who presented the results of their efforts to community partners also indicated that service-learning not only helped them understand the importance of doing high-quality work, but also improved their self-confidence as both a student and a future employee in their chosen field. By changing the way students see themselves, it can carry significant and lasting effects. Community partners that reported increased capacity due to the service-learning projects may also have changed the way they see students.

Perhaps most importantly, given the rationale for LSA's investment in STEM-focused service-learning initiatives, the grantees that surveyed students' likelihood of enrolling in another STEM course after taking a service-learning STEM course saw consistently promising results. Together these program examples and assessments bolster service-learning as a strategy to attract and retain students in STEM fields—while also addressing issues critical to all Americans' quality of life.

John Hamerlinck, June 2013

## NOTES

---

- <sup>1</sup> Tucker, G. Why STEM Education Matters. Corporation for National and Community Service. Retrieved online June 10, 2013 from [http://www.serve.gov/stories\\_detail.asp?tbl\\_servestories\\_id=931](http://www.serve.gov/stories_detail.asp?tbl_servestories_id=931)
- <sup>2</sup> Carnevale, A.P., Smith, N., and Srohl, J. (2010). Help Wanted: Projections of Jobs and Education Requirements through 2018. Washington, DC: Georgetown Center on Education and the Workforce. Retrieved May 1, 2013 from <http://cew.georgetown.edu/jobs2018/>.
- <sup>3</sup> Langdon D., McKittrick G., Beede D., Khan B. and Doms M. STEM: Good Jobs Now and For the Future. U.S. Department of Commerce. July 14, 2011. Retrieved April 17, 2013 from [http://www.esa.doc.gov/sites/default/files/reports/documents/stemfinaljuly14\\_1.pdf](http://www.esa.doc.gov/sites/default/files/reports/documents/stemfinaljuly14_1.pdf)
- <sup>4</sup> Fast-Track Action Committee on STEM Education National Science and Technology Council. The Federal Science, Technology, Engineering, and Mathematics (STEM) Education Portfolio. December, 2011. Retrieved February 8, 2013 from [http://www.whitehouse.gov/sites/default/files/microsites/ostp/costem\\_\\_federal\\_stem\\_education\\_portfolio\\_report.pdf](http://www.whitehouse.gov/sites/default/files/microsites/ostp/costem__federal_stem_education_portfolio_report.pdf)
- <sup>5</sup> Confucius. (n.d.). BrainyQuote.com. Retrieved June 12, 2013, from BrainyQuote.com Web site: <http://www.brainyquote.com/quotes/quotes/c/confucius136802.html>
- <sup>6</sup> National Math and Science Initiative. The STEM Crisis. Retrieved May 16, 2013 from <http://nms.org/Education/TheSTEMCrisis.aspx>.
- <sup>7</sup> National Service-Learning Clearinghouse. The Evidence Base for Service-Learning in Higher Education. Retrieved online January 24, 2013 from [http://www.servicelearning.org/instant\\_info/fact\\_sheets/he\\_facts/evidence](http://www.servicelearning.org/instant_info/fact_sheets/he_facts/evidence).
- <sup>8</sup> Exposure to Engineering Doubles Teens' Career Interest. December 6, 2011. Retrieved June 12, 2013 from [http://newsroom.intel.com/community/intel\\_newsroom/blog/2011/12/06/exposure-to-engineering-doubles-teens-career-interest](http://newsroom.intel.com/community/intel_newsroom/blog/2011/12/06/exposure-to-engineering-doubles-teens-career-interest)
- <sup>9</sup> <http://depts.washington.edu/ccph/>
- <sup>10</sup> <https://engineering.purdue.edu/EPICS>
- <sup>11</sup> <http://www.sencer.net/>
- <sup>12</sup> <http://serc.carleton.edu/index.html>
- <sup>13</sup> <http://www.compact.org>
- <sup>14</sup> Corporation for National and Community Service: Learn and Serve America Fact Sheet. Retrieved online on May 22, 2013, from <http://www.nationalservice.gov/newsroom/marketing/fact-sheets/learn-and-serve-america>
- <sup>15</sup> <http://www.dcc.edu/servicelearning/news/>
- <sup>16</sup> A video about this project is online at <http://youtu.be/w1XVdpFBOEU>.
- <sup>17</sup> California State University. (n.d.). In Wikipedia. Retrieved June 13, 2013, from [https://en.wikipedia.org/wiki/California\\_State\\_University](https://en.wikipedia.org/wiki/California_State_University)
- <sup>18</sup> <http://www.calstate.edu/cce/stem/learnandserve/>
- <sup>19</sup> The manual is available at <http://www.calstate.edu/cce/stem/learnandserve/products.shtml#student>
- <sup>20</sup> A video on service-learning in the Fresno State Chemistry department is available at <http://youtu.be/gtXLweeBZVU>.
- <sup>21</sup> <http://www.stem.floridacompact.org/stemsyllabi.html>
- <sup>22</sup> <http://www.wacampuscompact.org/learnandserve/>
- <sup>23</sup> Gallagher, K. Digging In: Urban Agriculture Grows Vegetables—and Community. DePaul Magazine. Winter, 2012. Pg. 14-15. Retrieved online June 1, 2012 from [http://www.depaul.edu/magazine/pdf/DePaulMag\\_Winter2012.pdf](http://www.depaul.edu/magazine/pdf/DePaulMag_Winter2012.pdf)
- <sup>24</sup> UW Parkside news release. Retrieved at <http://www.uwp.edu/news/newstemp.cfm?storyid=6042>. A video highlighting project work is available at <http://youtu.be/G4PdapFABmA>.
- <sup>25</sup> <http://youtu.be/y7TzHCnp7TI>