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# THE EVOLUTION OF SUCCESSFUL SERVICE-LEARNING COURSES IN THE COMPUTING CURRICULUM: FROM INFANCY TO INNOVATION \*

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## ABSTRACT

The purpose of this paper is to relate the evolution of successful service-learning courses in a school of computer science and information systems spanning over a 20-year period. The authors share their experiences in developing technology-based service-learning courses for both majors and non-majors. Most recently, these courses have enabled undergraduate first-year students to be exposed to exciting technologies, such as robotics and mobile app development. The challenges, benefits, and lessons learned are discussed.

**Keywords:** Information Systems, Information Technology, Computing Education, Civic Engagement, Problem Solving, Pedagogy, Citizenship, Computer Science, Software Engineering

## INTRODUCTION

The first university to institutionalize service-learning is believed to be the University of Cincinnati around the turn of the 20<sup>th</sup> century [7]. Since then, many

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institutions have embraced the idea of linking college students to the community via service-learning, and the number of courses continues to grow rapidly as educators recognize its value. Over 6 million students are currently involved in service-learning projects in the U.S., especially at the post-secondary level [6]. Service-learning is increasing in popularity and being incorporated into degree program requirements at colleges across the country.

Service-learning is a method of teaching and learning that utilizes practical experiences that provide assistance to a community organization. A student gains knowledge and develops skills linked to course objectives via these experiences. Service-learning has been further defined as an innovative pedagogical approach to realizing higher education's civic responsibilities [1, 2]. Courses with a service-learning component partner with outside community-based non-profit agencies and allow students to put theory into practice with real-world projects.

At Pace University, students can select from 29 university-wide service-learning course offerings in various curriculum areas, but many choose to register for technology-based courses while fulfilling a University civic engagement core course requirement. The Seidenberg School of Computer Science and Information Systems offers a variety of different service-learning courses. Each course enables computing majors as well as non-majors to explore the impact of computers on society. Civic engagement courses in the University's core curriculum have opened new opportunities for non-technology majors who are introduced to technology and civic engagement early in their academic experience [3]. More than two decades ago, the first service-learning course offering provided basic computer skills training for the community. Currently, several of the course offerings expose students to more innovative technologies, such as robotics and mobile app development. Each of the service-learning technology courses includes an experiential learning component and requires students to submit reflective journals at the end of the semester.

## **INFUSING SERVICE-LEARNING INTO TECHNOLOGY COURSES**

The following sections provide descriptions of six unique courses with detail about how instructors have infused service-learning into their courses and show how the computer-based service-learning courses have evolved over the past two decades.

### **Computers for Human Empowerment**

Having been designed and first implemented over 20 years ago, this course is the hallmark service-learning course offering of the Seidenberg School of Computer Science and Information Systems.

The computing portion of the course covers computer concepts, the MS Office Suite, introduction to programming, and Web page creation. In the service-learning component of the course, students become tutors who provide computer literacy for the community. They have an opportunity to work with a diverse group of community partners (representing ages ranging from late teens to octogenarians and various racial, ethnic, and socioeconomic groups) from various social services agencies throughout the

Metropolitan New York area. Students tutor their community partners on a one-on-one basis and within small groups under the supervision of the instructor. Throughout the course, students research and discuss contemporary issues related to computers in society and determine how the computer can be used to empower members of their communities.

One ongoing service project has students work with clients from a homeless shelter. Prior to client arrival in the classroom, students collaboratively develop a Client Questionnaire to assess each client's computer skills and knowledge and a PowerPoint presentation used to welcome the community clients and introduce them to the course when they first arrive in the classroom. At the end of the course a Certificate of Achievement is presented to the clients, and students write reflective essays focusing on their tutoring experiences. Self-reflection plays a crucial role in a service-learning course as particularly demonstrated by the following reflection:

I have retained valuable lessons and skills while being a part of this class. I learned how to teach, the value of team working and most importantly not judging a person regardless of where they come from. I also learned much more about computers and shortcuts that I know will help me throughout my life. The thing I value most was teaching the students. I created my lesson plans that they may learn and take something home that may help them as much as this class helped me. Creating these lessons also enhanced my writing skills and reinforced what my professor had taught me. (Pace University student, Fall 2009 semester)

### **Computer Hardware and Networking Technologies Courses**

Two other service-learning courses that have been offered for a number of years, *Networking Technologies* and *Computer Hardware: Troubleshooting and Maintenance*, are introductory course offerings in which students choose a term team project to help a community-based organization with troubleshooting, hardware, or software needs. Instead of in-class contrived problems, students also work on computer issues at home or work with family, friends, or colleagues' computers.

Students work in teams of two to four members and select a project from a list of suggested community partners. Particular topics and agencies are not mandated, however. Community representatives come to class early in the semester to explain their organization's needs. Some sample projects have included setting up a wireless computer lab with refurbished PCs or redesigning computer mice or other input devices for people with gross motor disabilities, tremors, or autism.

Students blog weekly about their hands-on troubleshooting experiences outside school, engaging their classmates for advice and additional learning beyond the confines of the classroom. In addition, students are encouraged to bring in malfunctioning hardware and network devices to troubleshoot within the classroom to complement in-class labs.

According to survey feedback, students thoroughly enjoy and remember what they learned via troubleshooting exercises with community agencies that would otherwise not have access to technology. Additionally, the service-learning experiences engender memories of helping an underserved population.

### **Web Design for Non-Profits**

One of the newer courses is *Web Design for Non-Profits*. Those who have taught introductory Web design courses know how difficult it is to simulate a real-world setting for course projects. One major objective of these courses focuses on Web usability and all of the other human factors that relate to the user experience on the Web. It is a challenge to design projects that meet these objectives. Hypothetical case studies or innovative simulations cannot offer students the same experience as working in a community with real-world users. By working with real users, students have the experience of dealing with the political, social, ethical problems, and competitiveness that exist in the workplace.

Students are presented with a non-profit organization desirous of a website or a non-profit organization with a poorly designed Web site and are instructed to implement a solution. This service-learning aspect of the course presents them with real-world problems, experience that goes beyond the textbook, classroom, and subject matter. Integrating service-learning into a Web design curriculum not only produces Web designers but also educates them about realizing their responsibility to empower their communities with technology.

During the first four weeks of design and information gathering, students work with their respective teams in the design, layout, and prototyping of their site. In the fifth week of class, the clients come to the university to meet with the competing teams and to see the prototypes. During the next four weeks, the teams modify the site to incorporate the client's feedback, perform usability testing and analysis of the site, and prepare for their final presentation. In the tenth week of class, known as "presentation week," the clients return to view the final products and receive the sites on CD. The clients are then given a week to "play" with each team's site after which the clients must choose which team better meets their requirements. Because of the approach used in this course, students learn to think critically and work as a team, knowing that at the end of the semester they are required to have a functional Web site developed.

### **Intergenerational Computing**

*Intergenerational Computing* is unique in the repertoire of service-learning courses; it blends the disciplines of technology and gerontology into practical hands-on innovative real-world projects in the community. Gerontechnology is the study of technology for the improvement of the daily function of the elderly [4]. The projects focus on bridging the digital divide, sometimes referred to as the "grey digital divide" [5]. Projects include setting up computer labs, touchscreen computers for physical therapy, teaching social networking and video chat skills, and, more recently, developing mobile apps for dementia patients.

Students study the process of aging, as well as applied computing technology as it prepares them to work with older adult learners. They learn how to teach technology to the elderly before walking into a geriatric facility. Readings in social gerontology, service-learning, and technology in action are assigned. Role-playing and sensitivity training with various props and assistive technologies allow students to emulate an older adult with visual, hearing, and motor skill disabilities. An assignment that includes

teaching computing skills to a senior citizen fosters an understanding of the need for patience when working senior learners.

Students attend an orientation session at a geriatric facility to familiarize them with the facility, and self-select to work with older adults participants. For seven weeks, students provide one-on-one weekly training sessions with the elderly residents by teaching them computer skills. After each training session, students contribute to a blog reflecting on their activities. At the end of the semester students plan and celebrate a “graduation” ceremony with the older adults and write an essay reflecting on all the semester’s activities. An excerpt from an essay is as follows:

I am happy I took this class. I still have some of that fear about turning old, but I know that there are people trying to make that period of my life easier. All of the ailments that currently afflict the elderly, such as hearing loss and issues with mobility, currently have technology being made to help older adults deal with them. This course and Stanley [older adult student] have taught me that a person’s life isn’t over the minute they reach 60. Older adults are still a part of society and it is great that there are people out there that focus on keeping them involved. (Pace student, 2009)

### **Problem Solving Using LEGO Robotics**

*Problem Solving Using LEGO Robotics*, the newest of the service-learning offerings, is an introductory robot-based design course that not only extends efforts in the field of computing and robotics but also serves the community by establishing robotics clubs in middle schools located in New York City and Westchester County.

Students in the course support several partner middle schools by directly teaching and mentoring the middle school students and by supporting the middle school teachers. Almost all of the assignments and activities in the course, both in Pace University classrooms and in middle schools, are team based, thereby challenging groups to work together to attain the common goal of each project, while respecting individual contributions and differences of opinion. Participants in this course develop skills in logical thinking, critical analysis, effective teamwork, and oral presentation, and develop an understanding of the value of community service and general interest in science and technology.

*Problem Solving Using LEGO Robotics* addresses the issues of the middle school students’ lack of interest in or challenges with math, science, and technology, as well as critical thinking. The partnership developed between Pace University and various middle schools provides an exchange of resources and talent and exposes students to new career choices. This partnership begins from the first week of the course and culminates at the end with the goal that the middle school LEGO team attend the FIRST (For Inspiration and Recognition of Science and Technology) LEGO Tournament with the intent of participating the following year. This tournament seeks to promote a philosophy of teamwork and collaboration and encourages competing teams to remain friendly, helping each other out when necessary.

## LESSONS LEARNED AND RECOMMENDATIONS

The authors have learned many lessons along the way. They believe that there are three critical success factors needed to integrate service-learning seamlessly into a content course: (1) teamwork, (2) communication, (3) student journal logs.

*Teamwork* was fundamental to the success of the community projects in the courses. Projects typically had too many tasks for one person or a dysfunctional team to achieve. *Communication* to all stakeholders was vital to ensure that project expectations were understood by all parties. In working with service-learning clients, the students and faculty had to be articulate in explaining their ideas and in conveying their knowledge of the course content. Additionally, if any of the partners were not in constant communication with each other, while being realistic about project expectations, the results would be an unsuccessful project. *Journaling* was an important aspect by which students were able to see a shift in their attitudes towards civic engagement. The journals were also instrumental in having a central repository of their interactions with the client in the event something went awry.

Important considerations and recommendations include the following:

- Most important is the challenge of obtaining clients and implementing a service-learning course. Determine if there is institutional support for service learning. Pace University has a Center for Community Outreach that provides support for faculty who wish to implement a service-learning course. The Center provides an orientation for faculty who are new to service-learning, assists in the location of a community partner, and provides a classroom teaching assistant. Instructors can also use [www.idealists.org](http://www.idealists.org) to locate nonprofit agencies with which to partner. If students are to demonstrate the technology to the client, then proper guidelines for transporting the equipment must be established.
- Groups of four work well. Larger groups make distributing the work load difficult, and accountability becomes difficult to handle as group size increases.
- Providing time within the scheduled class time for the groups to meet and work on the project is important. Requiring students only to meet as a team outside of the class may jeopardize the outcome of the project.
- The time of day the course is offered is important. Service-learning partners need to be consulted to determine what times best meet their needs. For example, when working with students in an afterschool program, classes need to be scheduled after 3 pm. In general, we have found more success with these courses if they are offered during the day rather than at night.
- Inviting the service-learning partners to the class and having them discuss their organization with the class is very beneficial.
- Time spent traveling to the community partner's locale must be taken into consideration. For some courses, which require equipment set-up at the locale, additional time must be factored in for checking that the equipment is working properly before the community activities begin.
- Budgeting should be made available to purchase equipment for those courses that need it or to support service-learning days at the culmination of each course. We are

in the process of looking for additional funds to obtain extra LEGO kits and to support service-learning initiatives.

## CONCLUSIONS

Service-learning benefits both the students participating and the community partners being served. Students find value in seeing immediate application of what they are learning in the classroom and use their skills and knowledge to better society and assist their community. Our service-learning courses at Pace University fulfill the university core requirement of service-learning and civic engagement while presenting computing technology in a way that is approachable, exciting, and easily learned by college students of all majors, meeting the additional goal of exposing more students to innovative computing technology in a subtle, but effective, way. We recruited service-learning partners who were willing and able to work with our faculty in designing and developing a cohesive course for all parties involved.

The Seidenberg School of Computer Science and Information Systems has demonstrated that teaching with a service-learning component can be successful when utilized effectively with adequate planning. Over the years, the service-learning offerings have evolved from a basic course that offers tutoring to members of the community and courses that offer basic hardware and software support to more innovative computing courses that bridge the “grey digital divide” and introduce students to exciting new technologies, such as robotics and mobile apps. Regardless of the specific material covered or the particular group served, the same goals can be met: to improve the computing competency and interest of both students and community partners and to instill in students a strong sense of empowerment to better their community and society through their applied skills.

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