10-2003

Where's (the) computer science in service-learning?

Pete Sanderson
Otterbein University, PSanderson@otterbein.edu

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SERVICE-LEARNING?*

Pete Sanderson
Otterbein College
psanderson@otterbein.edu

ABSTRACT

Service-learning is a form of experiential learning that integrates classroom concepts with related community service. Computer science faculty and students stand to reap great benefit from the integration of service-learning practice and philosophy into curricula. Many faculty are already doing so, yet computer science is not very visible in the service-learning community. Similarly, service-learning is not very visible in the computer science education community. It is imperative for those computer science faculty involved in service-learning to develop, apply and disseminate effective frameworks for integrating service learning into undergraduate computer science curricula so that its benefits may be more fully realized.

1. INTRODUCTION

I have been involved in the practice of service-learning in undergraduate computer science education for several years. Yet I struggle with many questions: Am I doing it "right"? How can I do it better? What are others doing? Why are there so few resources available to computer science faculty about service-learning? Why is the service-learning literature nearly bereft of computer science experiences? I cannot hope to address all those questions here. It will be enough if I can provide insight into some of these questions. I plan to do this by introducing service-learning, exploring the documented relationship between service-learning and computer science, and describing my current activity and plans. The title is paraphrased from that of an essential service-learning text [5].

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2. SERVICE-LEARNING

The term service-learning was coined in 1967 to describe the educational practice and philosophy of integrating classroom concepts with a related community service experience. Its benefits are many and varied but this quote from Honnet and Poulsen summarizes them in a profound way: "Service, combined with learning, adds value to each and transforms both."[8]

The "service" in service-learning refers to community service; the "learning" refers to experiential learning. John Dewey was an early advocate of experiential education and is considered by many to be the philosophical father of service-learning. David Kolb refined the work of Dewey into a widely known conceptual framework for experiential learning known as the Kolb Learning Cycle [10]. The learning cycle has four phases, but different individuals enter the cycle at different phases. The phases, in sequence, are: concrete experience, reflective observation, abstract conceptualization, and active experimentation.

Many if not most of our students learn most effectively when they are introduced into the cycle at the concrete experience phase. However for long term learning to occur they need to reach the abstract conceptualization phase. The connecting link is reflective observation. Service-learning activities provide students the concrete experience; it is up to faculty to provide structured reflection opportunities to facilitate student transition to abstract conceptualization. Reflection is sometimes called Athe hyphen in service-learning@ [5]; it is the link from the community experience to academic learning [7].

Institutions, departments and faculty practice service-learning in diverse ways. Experiences range from one-time service activities to individual courses with a service component to course sequences centered around long-term service projects. The relationship of the service component and the learning component can also vary widely. The Sigmon typology of service learning [17] uses the terms service-LEARNING, SERVICE-learning, service learning, and SERVICE-LEARNING to indicate the relative emphasis, balance and connection between them.

3. SELECTED SERVICE-LEARNING RESOURCES

There are many resources for information about service-learning and funding to support service-learning activities. Here are three that include information of interest to computer science faculty.

The National Service-Learning Clearinghouse [12] is a comprehensive resource for information related to service-learning: definitions, history, events, courses, syllabi, curricula , tools, jobs, and grants. It supports community-based, tribal, K-12, and higher education service-learning activities. It also has discipline-specific resources.

Campus Compact [1] focuses on higher education and encompasses community service as well as service-learning. In addition to the national organization based at Brown University, most states have Campus Compact organizations. Of the Midwest region states, Illinois Campus Compact headquarters are in Normal, Indiana's in Indianapolis, Michigan's in Lansing, Ohio's in Granville, and Pennsylvania's in Harrisburg.

Learn and Serve America [11] is a federal organization that supports service-learning in schools and communities nationwide through its grant programs. Its Learn and Serve grants are available directly to higher education institutions.

4. COMPUTER SCIENCE IN SERVICE-LEARNING

Computer Science is not very visible in the service-learning community. The National Service-Learning Clearinghouse website resource list for computer science syllabi and curricula has three entries. The Engineering list has four, only one of which has a computer science component. The Campus Compact website resource list for computer science syllabi has five entries, two of which are cross-listed with other disciplines and focus on use of technology such as GIS.

Nor is service-learning very visible in the computer science community. An ACM Portal search on the term Aservice learning@ found 15 results from 472,596 documents searched. Recent SIGCSE conference proceedings indicate a minor service-learning presence. SIGCSE 2000 included one paper [15], and SIGCSE 2002 included a panel [9] and a birds-of-a-feather session. The 2001 and 2003 symposia had no organized discussion or presentation of service-learning. The proceedings from the 2002 ASEE/IEEE Frontiers in Education Conference includes a paper addressing the benefits of partnering with nonprofit versus for-profit organizations for undergraduate database and software engineering projects [16].

The Curriculum 2001 Computer Science volume Final Report contains one reference to the term. Section 10.4 contains the sentence "When they engage in service-learning projects in the community or work with external clients, students begin to see the necessity for ethical behavior in very different terms."

Yet there is a lot of service-learning activity in computer science education. A recent Google search on the term > "service learning" "computer science" site:.edu= yielded over 11,000 hits. I investigated the first 250 and determined that 5-10% documented significant activities of the types discussed in this paper. Many of you reading this paper have been involved in service-learning activities. Why are we not more visible? What can and should we do about this? Perhaps we are unsure how to properly integrate service-learning into computer science and unsure whether our colleagues will accept it as effective pedagogy. We can and must do more.

5. SERVICE-LEARNING IN COMPUTER SCIENCE

There are numerous opportunities for serving the community while also learning computer science concepts and skills. Based on my own experience and others I have read or heard about, most activities fall into one or a combination of a few categories:

- Develop an information system for an organization's administrators
- Develop a web site for an organization or school
- Develop classroom software for a school

- Network an organization's computer resources
- Tutoring and other instructional activities

These kinds of activities are normally associated with a few upper division courses: software engineering, database technology, web site development, computer networks, capstone or practicum.

Our discipline also recognizes that computer scientists have an ethical responsibility to society. ABET Accreditation Standard IV-17 states: There must be sufficient coverage of social and ethical implications of computing to give students an understanding of a broad range of issues in this area. [2] This standard is typically met through the equivalent of a one semester hour course. Similarly, the Computing Curricula 2001computer science body of knowledge includes 16 core hours, equivalent to one semester hour of credit, for social and professional issues [6].

The academic goals of a course or component dedicated to social and ethical issues can be met through a much wider range of community service activities than those listed above. Many activities, particularly in urban environments, address the Digital Divide.

It is also worth noting, in light of the emphasis on gender issues at SIGCSE 2003 (see e.g. [13]), that service-learning opportunities may attract more female students to computer science. Eric Roberts stated in his keynote address that the software design community should be as diverse as its user community, and that software reflects the biases of its designer. Service-learning contributes to diversity both by attracting a more diverse audience to the discipline and by raising awareness of diversity in the minds of students as they reflect on their service-learning experience.

6. COMPUTER SCIENCE CURRICULA

There are far too many examples of service-learning in computer science to list or discuss here. In a few cases, service-learning in computer science has been institutionalized through special programs or courses. A few are described here.

The Engineering Projects in Community Service (EPICS) program [4] at Purdue University was created in 1995 to provide service-learning opportunities for engineering and computer science students. Many computer science educators were introduced to it at SIGCSE 2002 [9]. Its projects are multidisciplinary and its community partner relationships are long-term. Major computer science-related projects have included a database system for the Homeless Prevention Network and an online information management system for the EPICS program. EPICS programs have subsequently been started at several other universities including Notre Dame, Iowa State, Case Western Reserve and Butler.

The Urban Technology Project at San Francisco State University [3] combines technology-related programs from the university's community outreach organization. The most successful of their programs is the Cyber Business Center, a project of the Oakland Black Chamber of Commerce. The center's goal is to bridge the Digital Divide by bringing minority

and small businesses into the world of e-commerce. The CBC effort is significant in several respects:

- Its projects have the technical rigor to meet degree program requirements in computer science, both at the undergraduate and master's level
- It serves primarily the Chamber's constituents, the small businesses, rather than the Chamber itself. Most such projects directly benefit only the administrator.
- It exemplifies a long-term relationship between the university and a community partner.

San Diego State University course: CS 499 Community Service Learning [18]. This three credit hour upper division course was developed in 2002. Faculty decide on a per-semester basis whether to count it as an upper division elective, depending on the selected service project. They currently have an ongoing relationship with City Heights Community Technology Center, which provides the projects. Some projects span multiple semesters.

San Francisco State University course: CSc 695 Computing in the Community [19]. Developed in 1992, its two hours count toward graduation but not toward the major. Students serve a wide variety of community partners through projects that vary in rigor: web-site development, hardware and software troubleshooting, tutoring.

Southwest Missouri State University course: CSC 300 Service Learning in Computer Science [20]. Developed in 1998, this one hour upper division computer science elective can be repeated once. It is offered only in tandem with an approved upper division computer science course, usually Software Engineering. Students develop software for a variety of community partners; most involve web-site development or administrative databases.

7. MY CURRENT WORK AND FUTURE PLANS

The Center for Teaching and Learning at Otterbein College has recently formed a Service-Learning Professional Learning Community (PLC) to enhance the academic presence in service-learning. I was selected to participate based on my experience at Southwest Missouri State University [14, 15]. The PLC gives me the opportunity to interact with faculty from other disciplines who are also active in service-learning. Through the PLC, I hope to improve the pedagogy of service learning in computer science and to disseminate what I have learned to the service-learning and computer science community.

My current project in the PLC is to incorporate service-learning into our senior practicum, a two-quarter sequence in which students work in teams to develop and document a software project. We have started this year with a three-student team developing an online system for our institution's community service center that allows students and student organizations to record their community service activities and hours via the web. Program administrators can view information or produce reports to easily determine progress and retrieve data for grant reporting purposes.

In the long term, I hope to synthesize my service-learning knowledge and experience with knowledge gained from the Professional Learning Community, faculty colleagues in the computer science service-learning community and readings in service learning, to develop a

framework for integrating service-learning effectively into our computer science curriculum. This looks beyond the practicum. For example, the practice of reflection can be incorporated into one or more early courses to enhance student reflection skills for later courses and the practicum.

8. SUMMARY

Computer science faculty and students stand to reap great benefit from the integration of service-learning practice and philosophy into curricula. Many faculty are already doing so, yet computer science is not very visible in the service-learning community. Similarly, service-learning is not very visible in the computer science education community. It is imperative for those computer science faculty involved in service-learning to develop, apply and disseminate acceptable frameworks for integrating service learning into undergraduate computer science curricula so that its benefits may be more fully realized.

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