BOARD # 257: IUSE: Applying Scaffolded Projects for the Social Good to Integrate Service-Learning into Software Engineering Education

Dr. Chad A. Williams, Central Connecticut State University

Chad Williams, Ph.D., is a Professor of Computer Science at Central Connecticut State University and co-PI of the NSF-funded SPSG project. He has 13 years of experience leading community service learning initiatives including course projects, student-faculty-community research partnerships, and guiding student club-driven community efforts.

Dr. Stan Kurkovsky, Central Connecticut State University

Stan Kurkovsky is a professor at the Department of Computer Science at Central Connecticut State University. He earned his PhD from the Center for Advanced Computer Studies of the University of Louisiana in 1999. Results of his doctoral research have been applied to network planning and industrial simulation. Dr. Kurkovsky served and continues to serve as a PI on a number of NSF-sponsored projects, including four S-STEM grants, three IUSE grants, and an REU Site grant. He also received funding from NIH, NSA, and ACM. He has an established record of over 100 peer-reviewed publications in the areas of software engineering, mobile computing, and computer science education.

Nathan Sommer, Xavier University

Nathan Sommer has taught software engineering and other courses across the CS curriculum at Moravian University, The College of Wooster, and Xavier University, where he is currently using SPSG in the Software Engineering II and senior capstone courses.

Prof. Mikey Goldweber, Denison University

Professor of Computer Science at Denison University specializing in Computer Science Education. Additionally, I was a past Board member of Chair of ACM SIGCAS, and a current Associate Editor of ACM Inroads.

IUSE: Applying Scaffolded Projects for the Social Good to Integrate Service-Learning into Software Engineering Education

Abstract

The Scaffolded Projects for the Social Good (SPSG) initiative, funded by the NSF IUSE program, introduces a transformative approach to software engineering education by integrating service-learning through a structured framework and comprehensive toolkit. This project engages computing students in developing software systems that address community needs, enhancing their technical expertise, teamwork, and professional dispositions. By fostering collaboration among students, educators, and community organizations, SPSG creates projects that are both impactful and mutually beneficial.

Piloted in four courses across two institutions, the SPSG framework was implemented with 45 student teams during the Fall 2023, Spring 2024, and Fall 2024 semesters. These juniors and seniors worked on software solutions for non-profit and commercial clients, with the primary focus on community-based initiatives. Preliminary outcomes demonstrate improvements in students' technical competencies, communication skills, and social responsibility, while positively impacting community stakeholders. The SPSG initiative offers a replicable model for embedding community-based service learning into software engineering education and fostering the development of socially responsible computing professionals.

Introduction

The Scaffolded Projects for the Social Good (SPSG) initiative, supported by the NSF IUSE program, is positioned to reshape software engineering education by embedding service-learning into the curriculum. Through a software studio approach, students develop software solutions addressing real-world community challenges, honing their technical abilities, collaboration skills, and their sense of social responsibility. The initiative is supported by a structured framework and a comprehensive set of supporting materials that streamlines collaboration between students, educators, and community organizations, ensuring projects are meaningful and beneficial for all participants.

Piloted across courses at two institutions, SPSG focuses on sustainable service-learning models by documenting processes, facilitating mentorship, and creating adaptable resources for diverse educational contexts. By integrating socially impactful projects into software engineering education, SPSG equips students with the skills and mindset needed to address complex societal challenges and contribute as socially responsible professionals.

Background

Engaging teams of computing students, working over one or more terms to develop software systems that contribute or improve some aspect of their local community is a valuable high-impact educational practice [1-3]. However, this form of community-based service learning can

be an intimidating practice to implement [4,5]. SPSG introduces a framework for a software studio approach designed to seamlessly integrate service learning into the computing curricula [6,7]. The framework offers a low-adoption threshold solution for educators, providing a comprehensive toolkit to guide the process of selecting appropriate projects, and providing structure for all deliverables that fosters collaboration between students and community organizations, from the point of initial contact through project hand off. The project focuses on creating a flexible, easy-to-adopt framework that allows instructors to easily embed externally sourced community-based service learning projects into their courses. The ultimate goal is to leverage this high-impact educational practice to promote the development of professional dispositions and technical skills among students while working on real-world projects that serve non-profit and community organizations.

The SPSG initiative was launched to address the challenges of integrating community-based service learning into software engineering education. Traditional service-learning projects often require significant effort from educators to identify suitable projects, establish partnerships with community organizations, and manage the logistics of project implementation. These challenges can be daunting, particularly for educators who are new to service learning or who have limited resources.

To overcome these barriers, the SPSG project provides a structured framework and comprehensive toolkit designed to simplify the process of incorporating service-learning projects into the computing curriculum. The framework includes guidelines for project selection, templates for deliverables, and resources for facilitating collaboration between students, educators, and community partners. By lowering the adoption threshold, SPSG aims to make service learning more accessible and manageable for educators, while providing students with valuable opportunities to apply their technical skills to real-world problems.

The SPSG framework was piloted in four courses at two institutions, involving 45 student teams during the Fall 2023, Spring 2024, and Fall 2024 semesters. These teams, consisting of juniors and seniors, engaged in projects supporting community-based and commercial clients, with the majority working on non-profit initiatives, all using the SPSG framework. To assess the impact of these experiences on students, pre- and post-surveys with a longitudinal component were used to gather data on students' skill development and professional growth.

Project activities

SPSG has made significant strides in providing a framework for integrating service-learning into software engineering education. Key deliverables from the project include the SPSG Structure Guide, Instructor Guide, Code Management Guide, Project Feasibility Evaluation Rubric, Mentor Guide, and several questionnaires for clients. These resources are designed to streamline the project implementation process for instructors, guiding them through each phase of project planning and execution while encouraging collaboration between students, mentors, and clients. All materials are available on the project's website, providing open access to any educator interested in adopting the framework.

In addition to these resources, the project also ran a tutorial training sessions for instructors to

help them effectively implement SPSG in their courses. These sessions provided valuable insights into best practices for fostering collaboration with community partners to adapt and minimize risk to student learning outcomes when selecting service-learning projects. In addition, the SPSG initiative organized a Birds of a Feather (BoF) session to help build a community of educators sharing best practices around community-based service learning and learning more about common challenges.

Preliminary results

The SPSG initiative has demonstrated promising results, highlighting its potential to enhance software engineering education through community-based service learning. Piloted across four courses at two institutions, the project engaged 45 student teams—primarily juniors and seniors—during the Fall 2023, Spring 2024, and Fall 2024 semesters. Projects supported both community-based and commercial clients, with a strong emphasis on non-profit initiatives.

Key findings:

- **Skill development:** Pre- and post-surveys with a longitudinal component revealed significant improvements in students' competency development and professional growth. Students reported a deeper understanding of software engineering principles, along with enhanced abilities to apply these concepts to real-world problems. For example, students gained hands-on experience in software prototyping, project management, and client collaboration.
- **Community impact:** Projects undertaken by SPSG student teams positively impacted communities, particularly in non-profit sectors. One team developed a prototype digital gradebook solution to digitize paper submissions, with the goal of improving education processes in underserved regions of Africa. While the project faced challenges, it showcased SPSG's capacity to address meaningful community needs and expose students to global challenges.
- **Student engagement:** The SPSG framework's emphasis on continuous formative feedback enabled iterative improvement. Regular feedback from instructors, mentors, and clients helped students refine their deliverables, fostering stronger technical competencies and professional communication.
- **Instructor feedback:** Instructors noted that the SPSG framework streamlined the management of service-learning projects, easing collaboration between students and community partners. The structured approach and comprehensive toolkit facilitated project organization, ensuring deliverables were impactful and aligned with client needs.

Overall, these preliminary results underscore SPSG's effectiveness in integrating service-learning into software engineering education. By enhancing technical skills, professional dispositions, and community connections, SPSG provides a sustainable model for service-learning adoption in educational institutions worldwide. Future iterations will continue refining the framework through ongoing feedback from students, instructors, and community partners.

Conclusion and next steps

The SPSG initiative has shown significant promise in enhancing software engineering education

through community-based service learning. By offering a structured framework and comprehensive toolkit, SPSG has facilitated the integration of meaningful service-learning experiences into curricula, benefiting both students and the communities they serve. The pilot phase of the project has yielded promising results in terms of skill development, community impact, and student engagement.

Preliminary results indicate that students not only enhanced their technical skills but also gained a deeper understanding of the social impact of their work. The continuous formative feedback provided by the SPSG framework allowed students to iteratively refine their deliverables, ensuring high-quality outcomes that met the needs of community partners. Instructors found the framework to be a valuable resource for managing service-learning projects and fostering collaboration between students and community organizations.

In the upcoming year, the framework will be further refined and adapted to new educational contexts to broaden its applicability, including the involvement of community partners in socially valuable student projects that don't necessarily lead to a fully deployable software artifact. As survey data is analyzed, adjustments will be made to improve the SPSG framework and its associated tools, enhancing its value to instructors and students alike in engineering education programs.

The connections with the community through the BoF during the pilot phase also clarified common challenges, such as managing project timelines that extend beyond a single term and ensuring effective communication between students and community partners. This feedback provided valuable insights on areas to expand and refine the SPSG framework in future iterations.

In conclusion, the SPSG project has successfully integrated service learning into software engineering education, providing students with valuable opportunities to apply their technical skills to real-world problems while making a positive impact on their communities. The ongoing refinement and expansion of the framework will further enhance its value to educators and students alike, promoting the development of socially responsible computing professionals.

Acknowledgements

This work was supported in part by NSF awards DUE-2315322 and DUE-2315323.

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