Connecting Campus and Community through Web Development Service-Learning Projects

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Abstract – **In this paper we present a service learning course offered in Software Engineering Department at Fairfield University, which links two opposite cities together for good reasons. Web Development is a one-semester course required for undergraduate students and part of the Web Applications track for the graduate program. Currently, it operates with the service learning designation in the undergraduate catalog and annually being revised by university's Office of Service Learning. The course stresses web site design, current web technologies, and client-side scripting languages, including a class project. The paper discusses the service learning framework of the course, with the major role played by the project. The root of our approach is the belief that the best way of learning in engineering is by doing and the best way of doing is by actively participating in the community. Two case studies in which the web development projects have been paired with local community partners are first presented and the outcomes and success of them are later discussed.**

Index Terms – Community partnership, Service-learning, Software engineering education, Web Development.

INTRODUCTION

Although integration of service-learning into engineering curriculum is seen as a natural fit due to its hands-on approach, the other disciplines are demonstrating more progress in incorporating the service-learning model. In particular, exposing software engineering students to this model of learning will enhance their academic learning and prepare them better for the complexity of the technology and team-oriented workforce after graduation. On the other hand, community service organizations are in great need of relevant, custom-made quality applications which ease their work. However, non-profit or social services organizations usually face the lack of expertise to develop solutions for their technology problems and limited or no budget allocated. In the light of bridging these needs together and along our university mission of integrating living and learning, we have embraced the service-learning model in the Web Development class and in this paper present our successful stories of two community partnerships.

Web Development course is usually a required course in the Software Engineering undergraduate curriculum and often present in the graduate specialization tracks as well as an elective for other engineering disciplines. Traditionally in this class students design user friendly web sites and implement client-based application using authoring tools. However, with the new service-learning designation, the course has also emphasis on service-learning as teams of students do service to community by designing and building Web sites for local non-profit organizations, integrating academic and experiential community service learning and reflecting upon service experiences, which benefits students, faculty, and the community partners.

In this paper, we present two partnerships established during Fall 2009 semester to create websites for local non-profit organizations and provide them exposure on Internet to showcase their activities and highlight the events they sponsor. While collaborating with these organizations, the objectives of the course became more meaningful to the students. The educational objectives include teaching the Web Development course by incorporating the study of Web development techniques, while allowing each student to work in teams and experience real-world projects. The students learned how to interact to each other and with the customer for gathering the requirements, designing, developing and deploying Web applications while reaching out more disadvantaged groups and observing how their work can directly contribute to organizations in their community. The students furthered their course material understanding through reflection and appreciation of the topic in the larger context of software engineering as an applicable discipline. Students also learned course material from the community experiences perspective. They learned by doing and serving community. In working for communities' Web presence, the students collaborated with many different people, were involved in collecting information about people and facts that have been presented on the website, learned more about the communities they served, practiced interpersonal skills for management and team membership as well as been exposed to the social, ethical, cultural, and safety issues in application deployment.

The course outcomes including student experiences and reflections are discussed in the following sections of the paper. Overall, our service-learning structure enabled students and community to work together and fulfill each other needs and also generated additional collaborations.

MOTIVATION FOR AND BENEFITS OF SERVICE-LEARNING VS TRADITIONAL WEB DEVELOPMENT CLASS

Various approaches to integrate service learning in engineering disciplines have been documented by

researchers [1]-[6]. Some of the service-learning options are disciplinary capstone/senior projects, community-based research, first-year seminars, and other, with the service-learning component either required or optional. In all instances, service learning happens when community service is used as a learning tool that allows for students to work in the community, to address a need of that community while applying academic concepts taught in the classroom. This is a powerful learning tool that affects all those involved. There are many benefits for students including but not limited to, allowing students to work out academic concepts in real-world settings, learning how to manage major projects, and connecting to the community. Service learning allows for students to see an idea worked out in the real world while they still have access to a teacher and other school resources. Although students do not have jobs on the line they are able to work with real clients as their community partners. As noted also by other service-learning researchers [7]-[8], service-learning is not an additional assignment and rather an experience that allows students to "see academic concepts in action" and directly apply the theory learned in the class in nonacademic environment. Rather than completing a project that is never seen by anyone other than the teacher, these projects provide meaningful experiences that will be used in the community. Students are more likely to do well if they feel as their skills have the potential to make a difference. Moreover, students are able to learn valuable people skills they might not normally learn in a classroom setting. Students can actively see how the concepts that are in a textbook or in a presentation can affect real people. They are able to work in the actual world as opposed to the theoretical world and therefore being more passionate and engaged in their work.

Due to the scale of service learning projects, students have to learn how to manage a project of this size, as well as fill new roles and take on new responsibilities. For most students, these projects are the first time that a student has to deal with an actual client and they must work to make that client happy. A student working on a service learning project must learn how to work with the client, fulfilling different tasks that they may not have completed before. These valuable people skills can be learned during these projects and are very helpful after graduation.

Also, service learning allows for students to connect to the community. The community often has a need that the student can fulfill. By helping the community, the student can help enact meaningful change and connect with social issues. Students have the opportunity to extend beyond their campus community into the greater community and become active participants in a diverse society. Technology has a lot of potential to help improve communities and service learning is one of the ways in which students can see this potential and make it a reality.

In engineering, many of the skills that students are expected to have can only be learned by doing. Therefore exposing students to various educational experiences and real development projects not only enhances academic learning but also better prepare them for the many facets of technology after graduation. In the case of a Web Development course it is clear that not only the students benefit from the service-learning experience but there is also relevant and meaningful service provided to community in the form of customized websites. The websites will give online exposure to their services and further translate into increased donations or profits and in this way provide more support and training to people in need. The way we have chosen the community partners assures that the third criteria necessary for academic service-learning (as set forth by [9]), civic learning, is purposefully met. The following sections describe the overall setup framework for the service-learning class.

PROJECTS AS SERVICE-LEARNING COMPONENT

Two projects were undertaken by the Web Development class at Fairfield University, which allowed students to work with organizations from Bridgeport, Connecticut area who did not have the resources to hire professional web developers. The students were able to provide their services while learning how to work for a real client, in a real world setting while aiding the community.

The city of Bridgeport is located in Southern Connecticut along the Long Island Sound, approximately one hour away from New York City and surrounded by ones of the wealthiest counties in the United States. Bridgeport is home of around 138,000 people, with 18.4% of the population living below the poverty line, compared to only 7.9% of the population across the state. According to the US Census Bureau, 43.5% of the people of Bridgeport speak a language other than English in their homes and only 65% of the population has graduated from high school, compared to the 84% of the population who has a high school diploma in Connecticut as a whole [10]. Consequently, Bridgeport contrast with the rest of Connecticut, in terms of economics, race, and ethnicity, provides many community service opportunities, especially to students in nearby areas. Fairfield University is located in the town of Fairfield, Connecticut, one of Bridgeport's neighbors. Fairfield University is a private Jesuit Institution that enrolls students from all over the country, but especially from the New England and Tri-State areas, however the student body is mostly white and in the middle to upper-middle class. Following the Jesuit ideals that focus on education and service to others, we developed a relationship with two non-profit organizations in Bridgeport and helped fulfill their needs and in return, they provided opportunities to students to implement their learning into real world situations.

I. BAYM Project

One project was to create Computer Genesis's website with the look and feel of major electronics retailers' web sites. Computer Genesis, the largest computer warehouse in the area, is part of the Bridgeport Area Youth Ministry Inc.'s (BAYM), a non-profit organization in Bridgeport that served technology needs for over 15 years. It is a retail center for

re-manufactured computers, computers upgrades and repairs, also offering technology classes for young people ages 13-19. BAYM's mission is to help city youth discover and exercise their talents in a real world business environment by using technology, training, and career development. They currently operate at 30,000 square foot factory complex for technology based training programs for young people.

BAYM wanted a website that would allow them to advertise their Computer Genesis shop services to a larger audience and develop it as an e-commerce website that would also provide ability to conduct business online. Selling all kind of equipments, peripherals, and software, as well as fully refurbished computer systems at very low prices (as low as $77 for a basic computer) not only provides opportunities to people who otherwise might not have been able to afford them but also all the profits from the sales go back to their youth programs. To this extent the new website would allow BAYM to sell their products over the web and extend their client base through very competitive prices.

The project was a collaborative effort between the Web Development class and Capstone Projects classes. Web Development students were responsible for the web site design and client-side functionality whereas the sequence of 2 semester classes of Capstone Projects was responsible for generating the server-side coding (e-commerce part) of the web site. In this framework, a team of graduate students in the Web Development class initially met with BAYM administrators and received a brief presentation about what they were looking for, mainly there were requirements for a "sharp, exciting, technology-oriented, and clean" website. The students were given the opportunity to ask questions and were invited for a tour of BAYM to learn more about their people, mission, and services.

Subsequently, the students prepared a generic website prototype and visited BAYM facility not only to discuss the prototype and further elicit project's requirements but also get a better sense of the organization as a whole and learn about people they serve. At a later date, after refining the initial prototype, the group met again. This meeting took place in collaboration with the Capstone Projects educator and another mixed team of undergraduate and graduate students working on the server-side functionality of the website. A number of changes were considered necessary after discussing the website from all perspectives and all parties left the meeting feeling strongly encouraged.

After several more refinements of the web site and meetings, the Web Development group was able to complete the project and deliver it by the end of semester. Professional retail website look and feel, weekly specials, menu options and search functionality were among the featured delivered (Figure 1). The site was rigorously tested on different platforms and web browsers before it was released. The group also provided future recommendations and full documentation of the new website to the Capstone Projects team who will add the server-side functionality to it in the following semester.

FIGURE 1
COMPUTER GENESIS WEB SITE.

II.BBP Project

The other project was to work with Bridgeport Black Pride (BBP) to create a website mainly displaying their programs and events. BBP wanted an informational site to get their information out to the greater Bridgeport Area so that the community will be more aware of who they are and what they do, showcase their activities and highlights of the chapter, and ultimately increase funding.

BBP is a 501c non-profit organization that was established in Bridgeport in 1975. A small group of community activists started BBP in order to commemorate the legacy of Dr. Martin Luther King Jr. especially since at that time there was no official program in the City of Bridgeport or the State of Connecticut to honor Dr. King's legacy. The mission of BBP is to keep alive the dreams, ideas, and vision of Martin Luther King. Several years ago they started offering more events to the community that were in line with their mission such as "Women Who You Should Know" and "Men of Honor" both of these events honor and celebrate individuals who are making a difference in their community or workplace. More recently, they turned their focus on making a difference in the lives of area youth and organized the National Society of Black Engineer's Pre-College Initiative (or Bridgeport Black Pride N.S.B.E Jr. Chapter). This is a mentorship program for high school students interested in Science, Technology, Engineering and Mathematics (STEM) disciplines through which they involve minorities and students of color in various activities and events to prepare them for college in those fields.

A team of undergraduate students first met with the BBP partners and had a brief presentation about what they were looking for. Beside BBP administrators, high school students of BBP NSBE Chapter have been part of the group we collaborated with throughout the semester. Together with the Fairfield students they have been constantly involved in eliciting requirements, reviewing web pages content, and web site design. In this way, in the context of a college-level

Web Development course, we exposed high school students to software engineering technologies and concepts and promoted STEM education while serving community needs. After several web site prototypes and as many meetings the team was able to come up with a functional site that fulfilled BBP's objectives. The website was designed for easy use and reuse so that the high school students could add minimum enhancements if needed after deployment.

The BBP team used XHTML markup language to create the website. The site was constructed using Adobe Dreamweaver. All web pages used CSS style sheets to create a uniform layout and style. The web site maintains several features including a home page, BBP mission statement, membership information section, calendar displaying BBP' events and programs, and a link for donations. Picasa was used to create photo albums which the high school students could easily upload their photographs to (Figure 2).

FIGURE 2
BBP WEB SITE.

OVERALL SERVICE-LEARNING COURSE FRAMEWORK

The team project was the main service learning component and required to all students enrolled in the course. All students were required to complete a Web site design and development for a community service organization. Students were expected to meet and work toward project deliverables for 2 hours per week outside class time and their project work was worth of 45% of the overall grade for the class. Student learning was evaluated through class assignments, projects deliverables, documentation, other writing materials, code, etc. Students had to keep a project journal as a portfolio over the entire course. They did not only include the assignments, lecture notes, additional research materials, project work (such as documentation and deliverables for the project) but also personal and team notes and reflections. Additionally, weekly team meeting logs were required that provided current project status, issues experienced, week accomplishments, individual assessment for that week, the schedule for the following week and direction where the project is moving, so that it would allow students constantly and purposefully to reflect on their learning and relate it to their work for the organization. At the end of semester, the students had a customer-oriented presentation, project demo, and application deployment.

The students have been asked to reflect upon their service experiences throughout the semester in various ways. In the course framework, promoting interpersonal communication, self-awareness, and sense of civic responsibility is as important as learning problem solving skills and understanding of technical subject matter. Besides the weekly team meeting logs for the projects, students had 2 individual reflections and 2 group discussions when each team reflected as a group. We have administered these reflection assignments at the beginning of the semester, in the middle, and toward the end, and the questions have varied based on that. The questions were broad in nature regarding community needs, students' service contribution, the effect of the experience on their beliefs, career, and willingness to help other, lesson learned, etc. The students were required to submit in writing their individual reflections or a summary of the discussions as a group.

The learning outcomes for the course were aligned to the Software Engineering Department's outcomes for the Web Development class, which imply that students will acquire the skills and knowledge to succeed in the software engineering field through an in-depth exposure to the software development methodologies and tools.

Without the service-learning component in this course, the outcomes would include designing user friendly web site using design tools, implementing client based application using CSS and HTML using authoring tools, and understanding policies and ethics on Internet. The service-learning component highly improved the course and enhanced student learning in the following areas:

- Team-oriented work: All students registered for the course were required to work on team projects. Students learned to apply separation of concerns and divide up a large problem into sub-problems that could be solved individually, assign and schedule tasks, and then integrate the pieces together into a working solution.

- Exposure to real-world project with community partner: Each team formed a partnership with a local community organization to develop a real Web application. The students have been involved in the full experience, from gathering project requirements, design, implementation, testing, to deployment. Inspired by the fact that complete successful projects will be deployed, students have tried to produce the best possible results.

- Improved analytical thinking: The students faced real-world projects that spanned over disciplines with less well defined problem statements, and strict deadlines.
- Inter- and intra- personal learning: The students were encouraged to use non-traditional educational resources, such as using their teammates, their project customers and collaborators, the users of the applications, and searching the World Wide Web for similar websites.
- Applied resource management: Each team had to write a Team Resource Inventory document outlining both team's and customer's available resources and develop a proposal for the equipment, space, and software requirements for the project.
- Improved communication skills: The projects required written reports, presentations, oral communication with the customers, and intra-team communication. Students also had to deal with a group of people with various backgrounds, including African American high school students and their mentors, computer professionals and administrators, and their peers in other Software Engineering classes.
- Understand professional ethics: Issues of professional responsibility such as confidentiality, competence, intellectual property rights and computer misuse have been reinforced and maintained throughout the course, as well as the code of ethics principles within the team and in relation to the customers, users, and collaborators.

SUCCESSFUL STORIES AND LESSONS LEARNED

The two teams met with their clients during the last class to present their results. They were given feedback from the client and provided the client with the website to be deployed on their hosting service provider. The community partners gave professional recognition to students and provided them with certificates of appreciation with encouraging mottos, strengthening each team's further desire to succeed.

Throughout the semester and after the final meeting, students were asked to reflect on the assignments and provide the professor with feedback and lessons learned.

The BAYM team reflected on the assignment and said: "*We have realized that the technical component of our skill set as software engineers is just only one element. Team work and customer service is just as important… We feel inspired to not only work harder for the client but also for ourselves since this work reflects us and will be displayed in the community.*"

The team learned not only the material to the class, but also how to interact with a client in an educational setting while working for the community. They felt learning the material is one thing, but to learn how to work together with the client while serving the community was beneficial to their education. The team also felt that they had to work with each other and with people that not necessarily share the same views. They learned that they had to take advantage of

each other's skills and compensate for the weaknesses in order to complete the project on time.

The BBP team stated of its experience: "*It is fantastic that we have the opportunity to apply what we are learning in class to an outside project. We get to see the theory turned into practice while working in teams…By learning to communicate, things have been going smoother, we have worked out some problems, and we all feel as though we are learning something.*"

The team learned that communication with the client is essential to completing a project. If the client is unhappy with the design, then the team needed to fix the model. The team also learned that communication from the beginning is important as many of the problems they ran into could have been avoided with questions to the client at the beginning of the process. They felt that by working with a client who may not know what they want, the team learned the important questions to ask and to be diplomatic when answers may not return what they were looking for. The team learned how to guide a client through the process and to provide friendly customer service.

Both teams felt that the projects positively added to their learning experience. The teams were able to apply the concepts taught in class to a real-world setting and therefore learned the material better and were more engaged in the class. One student reported learning that donating time can be more fulfilling and meaningful then just donating money, while another student felt that they were able to provide services that in the end would help the organization more than a one-time monetary donation. Different students mentioned that they have learned a lot about the community of Bridgeport and the efforts to educate the students within their community, and also expressed the importance of using their education and knowledge to help others. Some students even reported feeling more inclined to concentrate on Web Development in the future due to the positive experiences they had received in the class. All students felt that they had learned valuable lessons and had faced unexpected challenges through these service-learning projects.

CONCLUSION

In this paper we present two mutually beneficial partnerships with non-profit organizations in the local community established during a one-semester Web Development service-learning class. The course is officially operating with the service-learning designation and engaging students in active learning that adds relevance to their academic work.

Our approach addresses the forthcoming challenges engineering students will face after graduation and better prepare them by increasing awareness of social responsibilities related to their profession, exposing them to diversity learning through involvement in diverse communities, and "serving to learn" in order to "learn to serve" as emphasis on civic responsibility. On the other hand the local community partners benefited from students' work and had websites deployed at the end of semester. They also actively participated with enthusiasm, welcomed the

students to their community, and rewarded students with valuable certificates of appreciations for successful projects. Moreover, disciplinary collaboration between students in different engineering classes have been facilitated due to the nature of a multi-layer project, whereas collaboration with a group of African American high school students mentored in STEM disciplines has contributed to the success of the other project. This collaboration truly benefited all the participants and set up the pathway for additional collaboration with our campus. Fully integrated into the mission of the school in the Jesuit Catholic tradition, the course will be sustained over time and more community partnerships will be developed.

ACKNOWLEDGEMENT

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