

December 2006

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Recommended Citation

Preiser, Lara and Navarrete, Carlos, "Community-Based Research: A Service-Learning Strategy for Interactive Web Development" (2006). *AMCIS 2006 Proceedings*. 264.

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Community-Based Research: A Service-Learning Strategy for Interactive Web Development

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ABSTRACT

Service-learning pedagogy integrates academic learning with community service. This form of active learning is becoming more prevalent in higher education as academic institutions strive to enhance student learning while providing service to the community. This study explores student learning outcomes of a service-learning project in an Interactive Web Development course, and the impacts of the community-based research (CBR) process on student learning. According to our findings, we propose an integrated framework of student learning in the context of the service-learning experience. This integrated framework of learning includes multiple dimensions of student development, linking the academic with interpersonal learning outcomes. Furthermore, the community-based research process facilitates student learning as it transforms the student into an *active* learner. The outcomes of this study provide a strategy for developing service-learning experiences in the Information Systems curriculum.

KEYWORDS

Service-learning, web development, community-based research, IS education

INTRODUCTION

Service-learning (S-L) is an educational strategy that combines academic learning objectives of a course with relevant community service. The integration of this experiential form of education into the academic curriculum of colleges and universities is on the rise. In the past decade, the post-secondary institutions have been criticized for the gap between the traditional curricular content and the needs of the society for workers and citizens with a new set of skills and competencies (Association of American Colleges, 1991). In the effort to re-think their role and responsibility relative to their community, and to renew their commitment to student learning, many academic institutions are forging educational partnerships with community organizations and integrating service-learning pedagogy into their curriculum.

In the context of Information Systems education, service-learning projects promote the application of course-specific knowledge to real-world problems, thus enhancing students' academic knowledge (Guthrie and Navarrete, 2004). The students engaged in service-learning also gain relevant experiences for future professional careers in Information Systems as they work through the complex problems embedded in the dynamic context of a community-based project. Furthermore, the use of community-based research as a service-learning strategy has a positive impact on the community affected by the outcomes of student interventions (Preiser-Houy, Navarrete, and Russell, 2005).

However, in spite of the growing body of literature on service-learning and its impacts, there is a need for more research to delineate the discipline-specific learning outcomes and the processes facilitating these outcomes (Eyler, 2000; Giles and Eyler, 1998). Furthermore, there is a dearth of research on the use of community-based research as a service-learning strategy in the academic core of the Information Systems curriculum.

This paper discusses the results of an exploratory case study that investigates the discipline-specific learning in the context of a service-learning project in Interactive Web Development course. The unique feature of the project is the use of community-based research strategy to promote student learning. The findings suggest that the collaborative nature of CBR facilitates learning as it transforms the student into an engaged and active learner. Furthermore, there is evidence that student learning

occurs on multiple dimensions, which include not only academic learning, but also interpersonal development and growth. The study's findings have implications for structuring effective service-learning experiences in the IS courses.

BACKGROUND

Service-learning (SL) teaching strategy integrates service experience with the academic curriculum and provides students with the opportunity for reflections (Jacoby, 1996). The principal components of S-L are the provision of a meaningful service based on the community need, the integration of service with the classroom curriculum, self-reflection on learning, and interpersonal growth of students. The primary motivation of integrating S-L into the higher education curriculum is to enhance student learning (Eyler and Giles, 1999). The service-learning literature documents a broad range of possible student learning outcomes, including enhanced academic learning and social / cognitive development (Astin and Sax, 1998; Eyler et al., 1997). In a study of fifteen hundred college students, Eyler and Giles (1999) found that participation in the service-learning projects had a positive impact on students' academic learning including critical thinking skills and broader understanding of the subject matter. They also found that service-learning contributed to students' interpersonal development and growth, including the ability to work well with others and to take the initiatives in accomplishing project goals.

A particularly effective form of a service-learning teaching strategy is community-based research (Strand et al., 2002). The dual goals of community-based research are to enhance student learning through the provision of meaningful community service and to promote social change in the community. The CBR practitioners argue that when students "collaborate with community members, critically analyze the sources of problems, and experience their own potential for social action", they are "more likely to develop the leadership skills, political awareness, and civic literacy that represent developmentally richer form of service-learning" (Strand et al., 2002, p. 123). Furthermore, the integration of CBR into the academic course helps transform students into active learners, and prepares them for civic responsibility and future roles as the agents of social change.

The research on service-learning in the IS courses suggests that this form of active learning contributes positively to students' learning experiences (Lazar and Preece, 1999; Lazar and Lidtke, 2002; Guthrie and Navarrete, 2004). In a S-L project for online communities, students learned not only about the software tools to develop web-based resources for the community members, but also the social aspects of working with clients in building the electronic resources for an online communication (Lazar and Preece, 1999). In a web design course of building web sites for non-for-profit organizations, students gained hands-on experience with the full systems development lifecycle from planning, analysis and design, to programming, testing, training and implementation (Lazar and Lidtke, 2002). In another web development course, students demonstrated deeper understanding of the system development process, and learned prototyping and project management techniques, as they worked with real clients to co-develop web pages for the clients' organization (Guthrie and Navarrete, 2004). Such experiences may not be easily attained in a traditional classroom environment. The challenge of the service-learning projects, however, is to ensure that the community partners adopt, integrate, and maintain applications built by students once their projects are completed. The integration of a community-based research strategy into an IS service-learning course can have a positive impact on the sustainability of the application co-developed by the student-community partner dyads (Preiser, Navarrete, and Russell, 2005).

RESEARCH QUESTIONS AND METHODOLOGY

The dual objectives of this study were to explore student learning outcomes in a service-learning project of web development and the impacts of community-based research on student learning. The research questions for the study were as follows:

- § What are the student learning outcomes of a service-learning project in interactive web development?
- § What are the impacts of community-based research on student learning outcomes?

Methodology

We utilized a case study research method to explore the student learning outcomes and to delineate the impacts of the CBR process on student learning. Case studies are best suited for exploratory research that interprets and comprehends the meaning of actions and investigates intensively the complexity of the unit of analysis (Benbasat et al., 1987; Yin, 1994; Miles and Huberman, 1994). We choose the case study method because the nature of our study was exploratory, and the study's

goal was to investigate intensively the student learning outcomes phenomenon and how it unfolded within a real-life context of a service-learning experience in web development. Furthermore, our aim was to interpret and comprehend the meaning of actions that facilitated the student learning outcomes.

The “case” for our study was a web site development project in a pilot service-learning course of Interactive Web Development. The pilot course was a pre-cursor to a full-scale implementation of the S-L pedagogy in the web development courses of the Computer Information System’s curriculum.. The course had a ten-week duration and covered topics ranging from HTML and Java Script programming to web design principles and project management. The context for the S-L project was the development of a second-grade web site for a school teacher. An IS student worked with a second-grade teacher (“the client”) to plan, develop, and implement a second-grade web site. While the student had some previous programming experience, neither he nor his client worked on a full-scale web development project before. Furthermore, the elementary school teacher had minimal technical proficiency and did not use technology in her classroom.

The unit of analysis for the study was the student learning outcomes embedded within the context of a S-L project in web development. The case evidence was obtained from interviews with the student and the client, the observations of the project, the student’s background survey, and the student’s reflections essay on his perception of the S-L experience. The case analysis consisted of two stages, descriptive and interpretive, and was guided by the S-L learning outcomes proposed by Eyler and Giles (1999). The analysis procedure included reconstructing interview tapes and observation notes into detailed written accounts, coding categories of learning outcomes and summarizing them into conceptually clustered matrices, and finally, searching for “patterns” by comparing results with patterns predicted from the literature on the service-learning outcomes.

CASE ANALYSIS

The service-learning project in web development consisted of four phases, including planning, design, training and implementation of a second-grade web site. The case analysis section details our findings for each of the four phases.

Project Planning Phase

The planning phase of the project had three objectives: 1) to determine and agree upon the target audience and the purpose of the second-grade web site, 2) to develop a project plan, and 3) to evaluate a software tool for web site maintenance. Throughout the planning phase, the student enacted the roles of a “*project manager*” and a “*technical expert*”.

Early on in the project, the student and the client worked together to evolve mutual expectations as to the purpose and the target audience of the client’s web site. The student commented, “I saw the value of a classroom site on multiple levels – a centralized source for parents to learn about the classroom activities, a place for students to get homework resources, and an opportunity for the teacher to learn a new skill in using technology in the classroom.” The client concurred, “I saw it as a win-win project in that I could get introduced to a technology that I was completely unfamiliar with, and at the same time create a vessel of communication with my families and students.”

In his role of a “*project manager*”, the student worked closely with the client to develop a schedule for the project. The project schedule included tasks, deliverables, and due dates. The experience of planning, monitoring and modifying a project schedule in a real-life context helped the student learn how to manage a project in the environment constrained by deadlines and unplanned circumstances, thus enhancing his academic knowledge of project management. In a role of a “*technical expert*”, the student took the initiative to learn a new software tool, Macromedia *Contribute*, to train his non-technical client to maintain her web site. “*Contribute* is the easiest piece of software I have seen, which was quite literally made for computer novices to maintain web sites. I think it is the right tool for training Ms. R. (the client) to maintain the site on her own,” said the student. Learning and evaluating a new software tool helped the student acquire software evaluation skills.

Web Site Design Phase

The aim of the design phase was to gain an understanding of the client’s requirements for the web site and to design the site. Throughout this phase, the student enacted the roles of a “*researcher*” and a “*designer*”. At the onset of the project, the client’s needs and requirements for the site were very vague. Consequently, in his role as a “*researcher*”, the student conducted Internet research to determine alternatives for the site’s graphical user interface, navigation strategy and the

content. He also worked with the client to develop a survey of the second-grade parents to get feedback on the desired content for the classroom site. In the process of conducting the Internet-based research and designing a survey, the student developed basic research skills.

Due to the client's vague requirements for the site, the student (the "*designer*") had to learn the prototyping tactics to evolve the site's concept through four iterative prototypes. The prototyping process required critical thinking to identify alternative concepts of the second-grade site. Each successive prototype was developed based on the results of the Internet research and the client's evolving preferences for the functionality and user interface of the prototypes.

Collaboration during the design process was not an easy task. The client commented, "I did not know where I was going with the project and since he [the student] was not familiar with the elementary school education, we were at times talking over each other's heads and across purposes, even though we tried to work together." The student reflected, "I have not worked one-on-one with a client before. So that really helped me to develop this aspect – to be able to understand what the client wants and to provide the solution that meets her needs and expectations. I also learned that sometimes the client's idea is not exactly what needs to be done, so I had to modify it into something more realistic and doable, and then try to 'sell' it to her."

By learning the prototyping tactics the student enhanced his academic knowledge. Furthermore, the collaborative nature of the design process helped student learn how to work with a non-technical client to evolve poorly defined requirements, thus enhancing his interpersonal skills. "The project helped my existing [technical] knowledge, for example, using HTML for programming the pages. But I also learned how to deal with the real client, share ideas with her, not being afraid to disagree with her, and how to talk to her in non-technical language. I can see many of these things coming into play in every (IT) consulting engagement".

Training Phase

Walton (1989) suggests that client mastery of a new technology is an important predictor of the use of that technology over time. In the context of a web development project, if a client is not properly trained to maintain the web site, there is a good chance that the site will become obsolete and abandoned over time. Consequently, the objective of the project's training phase was to teach the client how to maintain her web site, thus promoting her confidence and self-efficacy in utilizing a new software tool for web maintenance tasks.

At the onset of the training process, the student ("*trainer*") collaborated with the client to develop a training manual for using Macromedia *Contribute*, a web content management tool for non-technical users, in the Macintosh environment. The student commented, "One challenging part of the project was making the training manual. I had to learn how to make a step-by-step set of instructions with screen shots and narrative text. It took a long time to get it right." The experience of developing a training manual helped student enhance his documentation and training skills.

The student also conducted several training sessions on *Contribute* with his client. Training a non-technical client on the use of a new software tool was not an easy task. It required technical knowledge and critical-thinking to tackle the ill-structured nature of the training problems. The client said, "I found it very interesting, and frustrating at times, to be trained on the use of this technology. I was surprised how much work it was to go through training, and how difficult the training is for someone at my level of technical proficiency. It is like learning the Greek language – it is going into a complete different learning paradigm." The training experience helped the student improve his communication skills. In reflecting on the training tasks, the student said, "I tried to explain concepts in the language she could understand since she was not a technical individual. Often, I would have to stop and think – 'how could I explain things to her more clearly, without the technical jargon?'"

Implementation Phase

The last phase of the project entailed implementing the second-grade web site. This phase included the activities of setting up a server account for the site, uploading the site's files to the server, and developing web site documentation.

The student ("*implementor*") took the initiative to lead the implementation efforts, thus demonstrating his leadership skills. He worked with the client to test the web site for usability, broken links, and content accuracy. He also worked with the network administrator of the elementary school to set up the technical infrastructure for the site on the school's web server. Finally, he developed documentation materials for the web site. The student's involvement in the implementation activities contributed to his technical skills and academic knowledge of system implementation and documentation. Furthermore, he

enhanced his communication and collaboration skills by working with the client and the network administrator to implement the site.

The student also broadened his academic knowledge by learning how to develop a web-based application through all the phases of the systems development life cycle – from planning and design to training and implementation. The student said, “I never worked with a client on an [IT] project from start to finish. In my part-time jobs, I was always the one in the backroom, at the computer...I was just a programmer.” This project, on the other hand, provided the student with the context for learning the system development life cycle as it unfolded in a real-life setting. Through this active learning experience, the student gained a deeper understanding of the systems development process, and complemented his knowledge of HTML programming with the newly acquired academic knowledge of planning, web design, research, training, documentation, and implementation.

DISCUSSION

We set out to explore the student learning outcomes in a service-learning project of web development. We also aimed to assess the impacts of community-based research on student learning outcomes. Our findings are summarized in a theoretical framework presented in Table 1. Our research demonstrates that the student learning outcomes include *interpersonal development* (i.e., communication, collaboration and leadership skills), and *academic learning* (i.e., domain-specific and general knowledge / skills). Next, we will discuss each learning outcome and the impacts of community-based research on student learning.

Student Learning Outcomes	Skills and Knowledge Category	Skills and Knowledge Description
INTERPERSONAL DEVELOPMENT	Communication and Collaboration Skills	§ Evolving mutual expectations for web site
		§ Developing a project plan
		§ Evolving web site prototypes
		§ Developing training materials
		§ Working with school district’s network administrator
	Leadership Skills	§ Taking the initiative to evaluate a software tool for web content management
ACADEMIC LEARNING	Domain (subject-matter) Knowledge and Skills	§ Implementing the web site on the school’s server
		§ Project management skills
		§ Software evaluation skills
		§ Web design knowledge
		§ Prototyping knowledge
		§ Implementation skills
		§ Training skills
		§ Documentation skills
	General Academic Skills	§ System development life cycle knowledge
		§ Critical thinking skills
		§ Research Skills

Table 1. Theoretical Framework of Student Learning Outcomes in a Service-Learning Web Development Project

Student Learning Outcome: *Interpersonal Development*

The literature suggests that students’ interpersonal development and growth is one of the potential learning outcomes of a service-learning experience (Eyler et al., 1997; Eyler and Giles, 1999; Lazar and Preece, 1999). Our findings are consistent with the literature. We found that during the S-L project in web development, the IS student exhibited interpersonal development, including communication, collaboration and leadership skills.

During the planning phase, the student learned how to listen to and how to communicate with a real client to evolve mutual expectations on project goals and benefits. He learned how to share responsibility, authority and accountability with his client

to fulfill the project goals. During the design phase, the student learned how to explain technical concepts in a way that his non-technical client would understand so she could make informed decisions about the site's navigation strategy, the types of links to include on the pages, and the alternatives for integrating multimedia components into the site's pages. During the training phase, the student involved the client in the development of training materials, thus further enhancing his ability to explain the technical concepts of maintenance into the language that his client could understand. He learned how to appreciate different points of view and how to work with people who are different from him in their background and experience.

Structuring the service-learning project as a collaborative partnership through community-based research not only improved the efficiency of the team's working relationship and secured client's commitment to the project, but provided a real-world context for the student to practice and enhance his collaboration and communication skills. Learning to work well with a non-technical client and findings the social-technical solutions to ill-structure problems of web development, helped prepare the IS student for the professional IT work. Furthermore, CBR facilitated the student's interpersonal development by empowering him to take a leadership role in software evaluation and training activities, thus enhancing his capacity to lead and take initiatives in future technology projects.

Student Learning Outcome: Academic Learning

Service-learning experience has a positive impact on students' academic learning (Eyler et al., 1997; Astin and Sax, 1998; Eyler and Giles, 1999). The service-learning practitioners view learning as something that is actively constructed by the learners, rather than something that is simply given to them to master. While the literature suggests that service-learning participation has an impact on the students' academic learning, there is a paucity of research on the discipline-specific academic learning outcomes in the academic core of the IS curriculum. Our findings on the academic impacts of service-learning are consistent with the literature, yet they further extend prior research by categorizing the specific dimensions of academic learning that occur in a context of a service-learning experience in the IS academic core.

Our findings suggest that academic learning in a service-learning project of an IS web development course consists of two categories of learning – the *domain* (i.e., subject-matter) and *general* learning. The *domain* category includes the knowledge of web design, prototyping, and systems development life cycle. It also includes the skills of project management, software evaluation, training, documentation and implementation. The *general* learning category includes critical thinking and research skills.

During the planning phase of the project, the IS student learned how to plan and monitor the project's activities through all stages of the development life cycle, thus enhancing his project management skills. This experience provided him with a realistic view of the complexities and uncertainties inherent in planning and estimating real IT projects. The student also learned how to evaluate a new software tool, thus acquiring software evaluation skills.

During the design phase, the student learned how to evolve the web site's concept through a series of iterative prototypes as he experimented with the evolutionary prototyping tactics. Through the contextualized learning of prototyping the site's alternative designs and by leveraging the client's knowledge of elementary school education, the student acquired a deeper understand of web design principles and the concepts of web site usability. Furthermore, he acquired basic research skills by participating in the design and analysis of the web site surveys and by researching the existing elementary school web sites on the World Wide Web.

During the training phase, the student learned how to develop a training manual and how to teach his client to maintain the web site using the *Contribute* software. This experience provided the context for the acquisition of training and critical-thinking skills. Finally, the student acquired the implementation skills as he worked with his client and the network administrator to test and upload the web site to the school's web server. He also learned how to document a web site, thus acquiring technical documentation skills. Furthermore, the contextualized application of project planning, web site design, programming, testing, training, documentation and implementation tasks, broadened his academic knowledge of the systems development life cycle.

Community-based research facilitated the student's academic learning through integration of experiential and intellectual learning strategies. Through CBR, the student was engaged in active construction of academic knowledge as he critically analyzed the unstructured problems ranging from web design to implementation. And in the process of solving the socio-technical problems of web development, the student enhanced his domain and general academic learning. Finally, the contextualized subject-matter learning opened the student's eyes on how complex, uncertain, and time-consuming a real-life

technology project can be. This newly acquired knowledge enhanced the student's understanding of the type and conditions of work in the IT profession, and provided him with some of the requisite knowledge and skills to be effective in the real world of IT work.

CONCLUSION

Student learning in the context of a service-learning project in an IS web development course has multiple interrelated dimensions. This learning goes beyond the acquisition and practical application of the domain and general academic knowledge. It also includes interpersonal learning and growth.

Based on the outcomes of our exploratory study we propose an *integrated view of learning* in the context of a service-learning project of an IS web development course. This integrated view includes multiple dimensions of student's development and growth linking the academic with interpersonal learning. Through the CBR's empowering principles of collaboration, equality, reciprocity and social action, the IS student in our pilot study was transformed into an active learner as he tried to connect the "academy" to the "community", and in the process of doing so, enhanced his own capacity for personal, interpersonal and academic development.

The work of IT professionals is complex and multi-dimensional. More and more of the business clients and the IT managers expect their IT personnel to enact not only the technical expert roles, but the roles of collaborators, facilitators and leaders. Thus, the education of the IS students may need to go beyond the acquisition of technical skills and knowledge, and include learning of the interpersonal nature. The integrated aspect of the IS learning demonstrated in our study will be of value to the IS students as they commence their professional work in the dynamic, complex IT environments characterized not only by the ever-changing technology, but by the increasing emphasis on the effective management of the IT-client working relationships.

The findings of our study have important implications for future research and practice. Due to the exploratory, theory-building nature of this study, we have conducted an in-depth investigation of one case. Future research studies should test the proposed model of service-learning outcomes on a larger sample of IS students to strengthen the theoretical generalizability of the study's findings, and to replicate and extend the study's results. Another avenue for future research is to assess the differences in the learning outcomes of IS students taught under the service-learning versus traditional pedagogies. Finally, more research is needed to develop a multi-dimensional model of impacts that the service-learning pedagogy has on students, their community partners, and the faculty.

The practical significance of our study is in highlighting the significant potential of a service-learning experience and community-based research in transforming students into *active* learners. The outcomes of this study provide a strategy for structuring service-learning experiences in the academic core of the Information Systems curriculum.

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