

ENHANCING AUTHENTIC LEARNING EXPERIENCES THROUGH COMMUNITY-BASED ENGINEERING SERVICE LEARNING

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ABSTRACT

Service Learning, which started relatively late in engineering is an effective pedagogical approach that allows students to achieve their curriculum objectives while serving the needs of a community. Service Learning provides a meaningful context to address real problems in complex settings rather than simplified problems in isolation. Service Learning actively engages learners in developing new understanding and knowledge, promotes deeper insight, and therefore provides an enhanced authentic learning experience.

This paper discusses authentic learning as an instructional approach based on constructivism and elaborates on the effectiveness of Service Learning as a pedagogy that provides authentic learning experience.

INTRODUCTION

Constructivism¹⁻⁶ is a theory with its root from psychology and sociology. Constructivism has serious implications for teaching, and is widely supported by researchers and educators⁷⁻⁹. Constructivist approach to learning and teaching is based on the notion that learners construct their own knowledge rather than knowledge being transferred into their brain.

Learner's construction of knowledge is based on their past knowledge, the timeliness of new knowledge, and the learner's ability to understand the connections. This process forces learners to either modify existing knowledge or develop new ones.

Such learning experiences, which occur under actual conditions, while engaging learners is termed as Authentic Learning Experience. Authentic learning as an instructional strategy is based on the principles of constructivism and provides one of the most effective ways to actively engage the students in the learning process.

Engineering programs, in general, have some form of project components in courses. While the importance of using projects can not be minimized, it must be noted that well-structured class

projects (like the end-of-chapter in textbooks) may not provide authentic learning experience. Experiential learning¹⁰ and other instructional approaches such as scenario based learning¹¹⁻¹² may also provide somewhat authentic learning experience. The objective of this work is to show how Community-based Service Learning can enhance authentic learning experience.

COMMUNITY-BASED SERVICE LEARNING

Community-based Service Learning¹³⁻¹⁹ is a pedagogy that provides students with opportunities to learn, develop, and reflect through active participation and thoughtfully organized community involvement. It enhances the academic experience of students by relating academic content and course objectives to issues in the community.

The concept of Service Learning is not new, and it has been in use in various forms especially in liberal arts and education. Traditionally, engineering has been engaged with the community beyond the campus boundaries through technical assistance programs, university extension, and work of individual faculty serving as consultants to local community organizations. However, the community engagement is usually not systematically integrated within the engineering curriculum. Most programs tend to be focusing more on a student's professional development, rather than on their becoming socially responsible engineers who are prepared to address the needs of increasingly complex societies and communities using contemporary technologies in a cost-effective way.

In the recent past there has been a noticeable push to adopt Service Learning in engineering²⁰. Purdue University²¹⁻²² developed an innovative program that creates partnerships between teams of undergraduate students and local community not-for-profit organizations to solve engineering-based problems. This partnership provides many benefits to the students and the community alike. California State University (CSU) System²³ has 23 campuses. Currently, more than 185,178 students CSU System are providing service in California communities. Cal Poly Pomona, one of the 23 campuses, and its College of Engineering recently received an NSF grant to establish an Engineering Service Learning Institute.

IS THERE A DIFFERENCE BETWEEN TRADITIONAL PROJECT-BASED APPROACHES AND AUTHENTIC LEARNING?

In general discussions, engineering educators would agree with the concept of authentic learning and tend to think that a modified version of project based learning approach would do it all. This may very well be true in some cases, but it is incorrect in general. In order to develop a truly authentic learning experience, the theoretical underpinnings between the two approaches must be clearly understood. Traditional instructional strategies typically link curriculum and teaching methods such that an educator can deliver knowledge to as many students possible within a short period of time.

According to NCREL²⁴, *this approach assumes that properly managed instruction enables most students to acquire the skills and knowledge needed to continue to learn. Practice and repetition, with frequent tests of recall and recitation, characterize this approach. This approach is the only*

one that many parents and educators have ever known, and their level of comfort with this model will make it very difficult to supplant.

Thus the predominant, pedagogical model today is based on a teacher-centered, didactic approach to instruction. This is mostly due to the fact that educators, parents, as well as administrators have never encountered a learning experience in which they constructed meaning from the experience.

Authentic learning approach to teaching based constructivist model is very different from the traditional model. To implement an effective authentic learning environment based on constructivism, Jonassen's²⁵ eight general characteristics of Constructivist Learning Environments can be used as a guideline. The summary of these characteristics are:

- * Constructivist learning environments provide multiple representations of reality.
- * Multiple representations avoid oversimplification and represent the complexity of the real world.
- * Constructivist learning environments emphasize knowledge construction instead of knowledge reproduction.
- * Constructivist learning environments emphasize authentic tasks in a meaningful context rather than abstract instruction out of context.
- * Constructivist learning environments provide learning environments such as real-world settings or case-based learning instead of predetermined sequences of instruction.
- * Constructivist learning environments encourage thoughtful reflection on experience.
- * Constructivist learning environments enable context and content dependent knowledge construction.
- * Constructivist learning environments support collaborative construction of knowledge through social negotiation, not competition among learners for recognition.

While teaching approaches may utilize some of the above mentioned characteristics but effectively achieving the integration of all core characteristics is possible only by a well-thought out and properly implemented instructional strategy.

AUTHENTIC LEARNING EXPERIENCES THROUGH SERVICE LEARNING

Our experience in Service Learning reveals that Service Learning by its nature can provide authentic learning experience.

- * Authentic learning strategy invariably involves the learners in activities that deal with a real-life problem.
- * Service Learning involves real people in real time, and therefore, it contains certain elements of drama and dilemma, just like in real world.
- * In Service Learning projects, content knowledge usually is embedded in the situation in which it is used.
- * In Service Learning, students are not usually given engineering specifications to start with (as opposed to class projects or even industry based projects). This unstructured

environment enables the learners to construct new knowledge using their old knowledge and their interaction with community partners.

- * Construction of knowledge is accomplished through the completion of the project.
- * Clearly Service Learning projects have value beyond classroom which is an important requirement for authentic learning.
- * Service Learning projects are personally meaningful and fulfilling.

Thus Service Learning projects, in general, have the potential to provide an authentic learning experience. By carefully planning using the basic premises of constructivism, Service Learning can be effectively used to provide authentic learning experiences.

CHALLENGES IN IMPLEMENTING ENGINEERING SERVICE LEARNING PROJECTS

Developing long-term sustainable relationship with the right partners is the key for successful implementation of Service Learning. However, finding such partners, developing relationships, and identifying suitable projects are very difficult in reality. We have found that not every community organization is suitable for effective implementation of Service Learning. Organizations that seem like perfect fit from a pedagogical perspective may not be the right partners if there are no serious or relevant needs.

Another challenge in developing partnership is the fact that these community organizations may not be able to clearly define their needs. This is distinctly different from industry-sponsored educational and research projects that engineering schools are used to, where problems are well defined. In addition, the requests from community organizations are often vague and unstructured giving a misleading impression that there may not be a need (engineering) and even if there is one, it probably wouldn't satisfy the educational objectives. Hence, one of the first tasks in implementing Service Learning is to educate the community partners.

The process of identifying partners, cultivating relationship, performing needs analysis, and developing specifications for a product or service itself is an important learning process and it teaches students valuable real-world skills. However, implementing all these tasks along with the product development within reasonable time frame (2 or 3 quarters) is very difficult.

Finally, there are serious risk management issues in the context of Engineering Service Learning, and these issues need to be addressed and resolved.

CURRENT PROJECTS

At Cal Poly Pomona, a broad range of projects have been identified. Efforts are underway to develop a pool of projects that can provide authentic learning experience. Cal Poly Pomona students will be able to choose from this pool and work with the community partners to develop engineering specifications and implementation. A few of the projects that are currently underway are listed below.

Picture Exchange Communication System (PECS):

PECS is a training package that allows children and adults with autism and other communication deficits to initiate communication. PECS that is currently in use is limited and uses static pictures. Since every child requires his own PECS, it is difficult for care-providers to manage different PECS for different students and organize all the pictures. A new PECS that is easy to use for students and care-providers is currently under development.

Voice Activated Wheel Chair

People with disabilities have less independence and flexibility in their daily lives, and many of them depend on the wheelchairs for performing the most basic activities. A wheelchair that is controlled by voice can provide users a higher level of independence. Undergraduate senior level students from electrical and computer engineering department are currently involved in this project.



Fig. 1: Student team with the wheel chair

Geographic Information System (GIS) Based Emergency Evacuation Procedures:

Planning for evacuation of people in the event of a disaster (natural or due to terrorism) is important for every community. Most communities do not have an Emergency Evacuation Procedures (EEP), or even if there is one most people are unaware of it. Given this fact, if a disaster is to occur, most assuredly there will be panic and confusion over what to do and where to go. In addition to natural disasters, these communities are also vulnerable to terrorist attacks.

The ultimate objective of this project is to develop EEP for communities in Southern California, which has experienced several disasters such as earthquakes and wild fires displacing thousands of people and destroying homes. As a first step, this project currently focuses on developing a GIS based EEP for the campus community. Six undergraduate senior level students are currently involved in this project.

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BIOGRAPHIC INFORMATION

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