Effective Access Technology Project Discovery

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One of the challenges any capstone design program faces is the identification of suitable projects for its students. In the area of access technology, where the customers are often individuals in the community, this can be an even greater challenge, as universities can no longer rely on employer contacts or alumni in industry for projects. The Rochester Institute of Technology, in collaboration with several area agencies providing services to people with disabilities, has developed an embedded student program that puts students in an environment where they interact closely with clients and caregivers. These students have the opportunity to identify potential project needs and the technical background to know where engineering students may have the skills required to develop devices to meet client needs. This paper outlines this project discovery method, specifically as it applies to access technology.

Keywords: project discovery, access technology, multidisciplinary design, cooperative education

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Introduction

The Rochester Institute of Technology (RIT) initiated a process to facilitate the discovery of applications of effective access technology by embedding two students on a full-time basis with the Al Sigl Community of Agencies (ASCA). ASCA is a community of nonprofit agencies that provide specialized support for people with disabilities and special needs. The students’ objective was to observe the day to day activities within different agencies of ASCA and establish a dialogue with the clinicians and clients in order to identify effective access technology projects that RIT could potentially develop. The result was a list of 30 projects for RIT to develop with the ultimate goal of producing usable products for the ASCA stakeholders that have the potential to improve the quality of life for ASCA clients and/or the care provided by ASCA. Additionally, RIT students are introduced to user-focused design in an interdisciplinary setting that involves students and faculty in engineering, industrial design and business. A total of ten projects are actively being developed through the combined efforts of the Multidisciplinary Senior Design program in the College of Engineering, Industrial Design Studio courses in the College of Imaging Arts and Sciences and the Simone Center for Student Innovation and Entrepreneurship’s IdeaLab.

Background

The Rochester Institute of Technology: RIT is a "privately endowed, coeducational university with nine colleges emphasizing career education and experiential learning". It is RIT's career education focused learning through cooperative education (co-op) that sets it apart from other universities. A "co-op is full-time, paid work experience directly related to [a student's] course of study and career interests". RIT's co-op program is an integral part of the university and it is what helped foster a synergistic relationship with ASCA.

The Al Sigl Community of Agencies; In 1962 a group of motivated parents and advocates came together with a shared ideology; to provide individuals with disabilities, or, as ASCA likes to say, disabilities®, with the best care possible in order to improve quality of life and maximize community integration. This led to the establishment of the first Al Sigl Clinic, in Rochester New York. What made this clinic so revolutionary was that it was divided into different specialized clinics; each clinic provided expertise in a particular disability or task to improve the quality of life of those with a disability. This allowed for clinicians to better organize their resources in order to provide individuals receiving services with the best care possible. At the same time all of the specialized clinics shared common spaces such as exercise areas. This allowed for collaboration amongst clinicians leading to more knowledgeable clinicians and improved care for the clinic’s members. ASCA has grown from supporting 3,000 people to servicing the needs of over 50,000 patients and has expanded to 18 buildings on 6 different campuses. After 50 years of growth, ASCA is positioned to not only maintain their current size and capacity, but to continually improve the quality of their care and services with the aid of their member agencies.

ASCA defines themselves as a "collaborative community network that provides cost-effective real estate, business services and philanthropic support to a
The six agencies that comprise ASCA are as follows.

- CP Rochester
- Epilepsy-Pralid Inc.
- Medical Motor Service (MMS)
- National Multiple Sclerosis Society (Upstate New York Chapter)
- Rochester Hearing & Speech Center
- Rochester Rehabilitation

Each agency shares a common mission, to remove barriers and obstacles to improve their client’s quality of life. Additionally, each agency seeks to increase awareness of their mission in order to increase advocacy, support funding, clinician collaboration, and innovative input from external sources like RIT.

**Establishing the Relationship**

**Embedded Engineering Students: History at RIT**

ASCA is not the first organization that RIT students have had the opportunity to work with in this fashion. In fact, clinical internships for engineering students, especially students studying biomedical engineering, are not uncommon. The purpose of embedding an engineering student within a clinical facility is to place a student with significant technical expertise into an environment with a variety of problems and needs that could be addressed with the proper application of technology. The student’s objectives are to observe, take notes, and engage in in-depth discussions with the clients and clinicians. The students are expected to brainstorm solutions to problems they observed or that are expressed by the clinicians and the individuals they are providing services to. The students then record and document their observations and project ideas for continuity and accountability.

At RIT, an electrical engineering student was first embedded within the physical therapy clinic at Nazareth College (Rochester, New York) in 2006. The student identified a number of projects that included adjustable parallel bars, a balance bicycle, and a motion tracking system that formed the basis of a number of Multidisciplinary Senior Design projects supported with a grant from the National Science Foundation. This also established an on-going relationship with Nazareth College that provided a similar opportunity for a 4th-year biomedical engineering student in 2014.

**Embedded Engineering Students: ASCA**

A hallmark of ASCA has been providing services to people of all abilities. Their leadership of ASCA recognized the value of collaborating with RIT to develop devices and systems that incorporated technologies, design and engineering to provide more effective access to life’s opportunities for individuals with a wide variety of physical and cognitive impairments or limitations. To facilitate that collaboration, ASCA provided funding to support embedding a senior biomedical engineering student and an electrical engineering student who recently completed his degree requirements through RIT’s cooperative education program.

The students participated in a series of rotations in each of the Al Sigl member agencies such as Mary Cariola Children’s Center, a school for children with special needs. In addition to direct patient care, the students also observed various aspects of the support infrastructure of the various agencies by way of obtaining a more holistic perspective of the environments in which the agencies operated. In short, the overall objective was to entirely immerse the students into the operation of the Al Sigl organization and the common resources that it provided to the member agencies and the individuals they served. The students were employed on a full-time basis and would typically spend four days a week on site and one day to organize and record their observations, ideas and discussions; brainstorm and benchmark potential projects; and meet with faculty mentors.

Scheduling was very flexible allowing the students to determine the best course of action for embedding themselves with a given agency. The week would often begin with an agency overview exposing the students to the topics of greatest interest to an agency and areas that the students should interact with during the remainder of the week. The number of weeks spent with any one agency was determined by the structure and range of services that were being provided. The responsibility for scheduling was entrusted to the students based on their observations and experiences.

The original cooperative education proposal set an objective of three to four projects to be identified at the end of a 15 week period. The students surpassed this expectation by identifying 30 projects that preliminary proposals were developed for. The students’ activities then transitioned from a discovery and proposal mode to project development and management mode. In a sense, the students were responsible for shepherding these project ideas that included determining the best resources to engage at RIT and acting as a liaison between the stakeholders in the Al Sigl agencies and the design and development groups at RIT.

**Project Development and Management**

**Project Selection**
At the conclusion of the first semester of employment for the ASCA embedded students, the project concepts the students identified were compiled into a summary document that included a brief (~½ page) description of each potential project. The students brought their list of 30 project concepts to RIT’s engineering capstone program, Multidisciplinary Senior Design (MSD), where they were given an initial screening to determine which were the best candidates for the capstone program and which would be a better fit elsewhere. The screening process is already used with industrial partners who propose projects, so this is not specific to Access Technology applications. Acceptable projects:

- Must present a challenging engineering problem that can be solved by a team of senior engineering students working for two semesters;
- Must have a committed customer, available to participate in design reviews throughout MSD;
- Must not prohibit students from meeting course requirements, which include public dissemination;
- Must not be on the critical path;
- Should be multidisciplinary in nature, representing two or more engineering disciplines, or engineering with industrial design or business students;
- Should be fully funded (some internal funding is available to support a subset of projects, particularly those with a humanitarian or entrepreneurial focus); and
- Should identify a faculty member to serve as a local “champion”. (The embedded student(s) take on this role, maintaining and fostering their relationship and speaking on behalf of the customer when necessary, and serving as a subject matter expert.)

In 2014-15, two of the 30 possible projects were identified as good candidates for the MSD program. In addition to the screening criteria listed above, the overall number of projects was limited by the enrollment of students by discipline in the MSD course. For the two projects identified, a faculty member from the MSD program worked with the embedded students to add detail to the project proposal, develop a preliminary list of customer requirements, and perform some initial benchmarking.

Simultaneous to pursuing placement into the MSD program, the embedded engineers worked with a group of graduate and undergraduate Industrial Design students working on solving real world issues in access technology, in an environment called “Studio 9.30”. The Studio 9.30 students, under the supervision of two faculty members in the Industrial Design department, selected the projects that most interested them and that best fit their skillsets. One of the embedded engineers served as a liaison between Studio 9.30 and ASCA, facilitating communication along with visits with clients and clinicians. The effective communication and logistics allowed for studio 9.30 to focus on design and developing project solutions. In this particular case, the ASCA projects chosen by Studio 9.30 students were a body cooling system for people with Multiple Sclerosis, an improved switch for adaptive toys, and a smart rug used for rehabilitation (the students had other sources of projects besides these). The body cooling system was one of the projects slated for MSD, and the preliminary work done by the Studio 9.30 students became part of the initial project proposal provided to the MSD students at the start of their project.

**Transition to Capstone Design**

Once projects directly enter the MSD pipeline, they are staffed and assigned a project advisor. In the case of the ASCA projects, this process becomes slightly more complicated. The MSD program assigned teams of engineering students, but a group of Industrial Design students continued on the ASCA projects, and a business student joined the team. The students from these other colleges were the responsibility of faculty advisors in their home department, which simplifies the administrative overhead associated with multidisciplinary teams that include students from a variety of different programs. The embedded student continued to serve as a liaison between ASCA and the project teams. The flexible schedule of an embedded student employed full-time simplified the logistical challenges of trying to coordinate the varying schedules of customer(s), engineering capstone students, Studio 9.30 students, business students, and other consultants.

**The RIT IdeaLab**

Beginning in 2014, the Center for Student Innovation at RIT began holding events known as IdeaLab. An IdeaLab involves a weekend of innovative problem solving where students, coaches, and project sponsors work together to brainstorm solutions to problems facing the community. To date, the IdeaLab events have been focused on HealthCare and Assistive Technology. The community is represented by the project sponsors, such as organizations of the Al Sigl Community of Agencies, while coaches, who are RIT faculty with design experience, assist the students as they learn user-focused design in an interdisciplinary setting. At the end of the weekend students present their solutions to the project sponsors and if the solutions are judged to be feasible, they can potentially continue to be developed at RIT. If the project sponsor feels the presented solution is not viable, the project can go through another IdeaLab iteration or other options can be explored.

The Fall 2015 IdeaLab featured the following projects, all from the ASCA project list:
• Dynamic Arm Support - a mechanical support for individuals with movement disorders
• Parental Control for Adults - provide behavior specialists a better way to monitor and control phone and TV for residents of group homes
• Help Dress - assistance for individuals who have had a stroke getting dressed
• Float Safe - safe support for individuals participating in water therapy who have a tracheostomy tube
• Toilet Paper Dispenser - controlled release of toilet paper for individuals with cognitive impairments or behaviors
• Device tracker - to identify the location of devices that are commonly misplaced

One of the students embedded with ASCA worked with the IdeaLab organizers to select the projects, contacted the project sponsors for the event and even acted as the spokesperson for three projects whose sponsors could not attend. The IdeaLab was considered a complete success in that all the project sponsors expressed interest in the proposed solutions. Two of the projects, Dynamic Arm Support and Float Safe were selected for further development as part of a user-focused design class in the College of Applied Science and Technology. Other projects are currently under consideration for the MSD program.

Summary

The project discovery process outlined here is specific to a particular agency and particular students/projects, but it can also be represented as a more general timeline with task owners. This is summarized in Table 1, and could be applied at other institutions.

Current State and Next Steps

Currently, there are ten projects identified by the AI Sigl co-op students that are being developed at RIT, a number of which were highlighted on November 10, 2015, at RIT’s 3rd Annual Effective Access Technology Conference. ASCA’s satisfaction with the work of the original students has enabled two additional co-op students to be supported through the remainder of the 2015/2016 academic year. Based on the success of this program, the Rehabilitation and Neurology Center at Unity Hospital, part of the Rochester Regional Health System, has engaged a biomedical engineering student in a similar embedded program to come to better understanding of their needs and help develop innovative projects that will facilitate their activities. In the near term, RIT is looking to form or expand relationships with existing businesses and manufacturers to help produce products that reach the marketplace and end users. These activities all fall within one of the core initiatives of RIT’s recent strategic plan to foster growth and on-going innovation in the area of Accessibility and Inclusion.

References
1. http://www.rit.edu/overview/
7. http://scholarworks.rit.edu/eatc

Table 1: Term-by-term timeline for bringing projects into a capstone program.

<table>
<thead>
<tr>
<th>Responsible Person</th>
<th>Term 1 (and prior)</th>
<th>Term 2</th>
<th>Terms 3+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedded engineer(s)</td>
<td>On-site at local agencies</td>
<td>Continue on-site at local agencies, gather background information; serve as liaison to Studio 9.30 students</td>
<td>Serve as agency liaison to MSD team</td>
</tr>
<tr>
<td>Engineering Faculty</td>
<td>Review proposed projects with embedded engineer(s), assign MSD students to selected projects by discipline</td>
<td>Consult with MSD team as required</td>
<td></td>
</tr>
<tr>
<td>Design Faculty</td>
<td>Supervise Studio 9.30 students</td>
<td>Consult with MSD team as required</td>
<td></td>
</tr>
<tr>
<td>Studio 9.30 students</td>
<td>Review proposed projects from embedded engineer(s), perform preliminary concept generation and prototyping</td>
<td>Continue work on project with MSD team, as applicable</td>
<td></td>
</tr>
<tr>
<td>MSD Student Team</td>
<td></td>
<td>Begin MSD project using Studio 9.30 work and as available, and embedded engineer(s) input</td>
<td></td>
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