Effective Access Technology Discovery Program

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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 Effective Access Technology, where the customers are often individuals in the community, this can be an even greater challenge, as universities can not necessarily rely on employer contacts or alumni in industry for project proposals. The Rochester Institute of Technology, in collaboration with several area agencies providing services to people with disabilities, has piloted an embedded student discovery program that puts students in an environment where they interact closely with clients and caregivers to identify user needs. These students have the opportunity to identify potential projects that address these needs and the engineering background to recognize possible interdisciplinary solution paths. These project ideas result in proposals that can be refined and reviewed for implementation through a variety of on-going programs at RIT. This paper outlines this project discovery method, specifically as it applies to Effective Access Technology.

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

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Introduction

The Rochester Institute of Technology (RIT) has piloted a process intended to facilitate the discovery of solutions that promote more effective access for individuals with varying abilities 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' objectives were 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 projects which could potentially provide more effective access to life's opportunities through the incorporation of appropriate technologies. This type of development effort is referred to as Effective Access Technology. Research and development in the areas of accessibility, inclusion and assistive devices fall under this broad umbrella.

The result of the students' efforts was a list of 30 projects that might be developed at RIT with the ultimate goal of producing usable products for the ASCA stakeholders. These projects would have the potential to improve the quality of life for ASCA clients and/or the care provided by ASCA. Additionally, RIT students were introduced to user-focused design in an interdisciplinary setting that involved 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. The overall time line of this effort is graphically depicted in *Figure 1*.

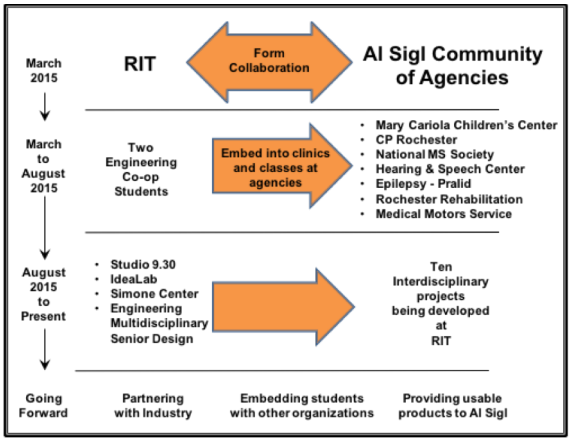

Figure 1 Effective Access Technology Discovery Program - Time Line

Background

The Rochester Institute of Technology: RIT is a "privately endowed, coeducational university with nine colleges emphasizing career education and experiential learning" [1]. The career education focused learning through cooperative education (co-op) is a key element

of an RIT education. 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 has 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 philosophy and mission; to provide individuals with disabilities, or, as ASCA likes to say, ~~dis~~abilities®, 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 [2]. 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 among clinicians leading to more knowledgeable clinicians and improved care for the clinic's patients. 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 growing array of independent human service agencies that serve children and adults with ~~dis~~abilities® and special needs" [2]. 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 [2].

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 [3,4]. 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 upper level undergraduate 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 [5,6]. 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 with ASCA

A hallmark of ASCA has been providing services to people of all abilities. The 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 challenges. 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 the 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 spending time 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 student met with their faculty advisor on a weekly basis and were responsible for producing on-line documentation of their progress. The faculty advisor was responsible for establishing and monitoring the student discovery relationship with ASCA for RIT. Thomas O'Connor, the Chief Operating Officer for ASCA, was responsible for arranging student introductions and interaction with the various ASCA agencies and organizations.

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 which 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 the development of 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. Students were provided a significant degree of autonomy in these efforts but were also carefully mentored by faculty and domain experts in all aspects of the project development process including their interaction with individuals in a variety of disciplines as appropriate for a particular project.

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 presented their list of 30 project concepts to the review panel for the Kate Gleason College of Engineering Multidisciplinary Senior Design (MSD) program, where they were given an initial screening by MSD program personnel 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 Effective Access Technology applications.

In the 2015-16 academic year, 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 Effective Access Technology, in a consultancy given the name "Studio 9.30". The Studio 9.30 students, under the supervision of two faculty members in the Industrial Design department focused on design and ideation. The recently graduated electrical engineering student served as a liaison between Studio 9.30 and ASCA, facilitating communication along with visits with clients and clinicians. The effective communication and logistics between the engineering student and the industrial design students 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. In this case, the Studio 9.30 team's work on the design solution allowed the MSD team to focus on the technical details of the design, such as thermal analysis and how to validate system performance. The other project undertaken by the MSD program involves an "All Terrain Walker" which is intended to assist an individual with mobility challenges to navigate soft or

changing ground conditions including those normally found on hiking trails.

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 involved. The MSD program assigned teams of engineering students that established and maintained a relationship with the Industrial Design students and a business student. These students had been part of Studio 9.30 and wanted to continue working on the original ASCA projects. The students from these programs and colleges were advised by faculty in their respective home departments and earned credit for their own separate courses. This facilitated some of the administrative issues associated with interdisciplinary teams that include students from a variety of different programs. The original electrical engineering 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.

Current State and Next Steps

Currently, there are ten projects identified by the Al Sigl co-op students that are being developed at RIT. ASCA's satisfaction with the work of the original students has enabled two additional engineering co-op students (one upper level electrical engineer and one 3rd year biomedical engineer) 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 4th year 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 create 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.

Summary

A pilot program has been initiated that involves engineering students expending full-time effort in environments that provide services for individuals with various abilities for the purpose of developing projects that address the needs of those individuals as well as those of the professionals who support those individuals. The focus of this effort is to determine if application of various technologies and design processes can result in solutions that provide more effective access to life's opportunities for these individuals. In broad terms this has come to be referred to as Effective Access Technology. The interaction by the students with the end-users and other stakeholders has resulted in project proposals that have been reviewed and evaluated for incorporation in different interdisciplinary programs across RIT for the purpose of development and ultimately realization of solutions that address the original user needs.

As evidenced by the large number of projects that have resulted from this pilot program, a major challenge is developing a pipeline of productive development channels across campus and with external partners to bring these ideas to realization.

In this case, the sponsoring organization, the Al Sigl Community of Agencies, has been satisfied with the results to date to the extent that they have committed to providing funding for another pair of engineering students. In terms of growing this effort moving forward, a local rehabilitation and neuroscience unit at a major medical center in Rochester, NY has recently committed to sponsoring a full time biomedical engineering student to follow a similar process to identify needs and propose projects in that clinical environment. From an institutional point of view, RIT has endorsed this type of interdisciplinary effort in accessibility and inclusion across campus as a significant aspect of its current strategic plan.

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