

REHABILITATION SCIENCE AND ENGINEERING CENTER: A CASE STUDY

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ABSTRACT

The purpose of this paper is to describe the proposed development of a Rehabilitation Science and Engineering (RSE) Center, using The Ohio State University (OSU) as a case example. The mission of the proposed RSE Center at OSU is to improve the quality of life of individuals with disabilities through the application of science and technology. The proposed RSE Center has three primary components: education, scholarship and service, which are consistent with the University's mission. The components of the RSE have naturally developed through a grassroots movement in rehabilitation engineering and assistive technology throughout the University and Medical Center. The proposed center will synthesize the existing education, scholarship and service activities; thereby creating a synergistic program focused on improving the quality of life of individuals with disabilities.

BACKGROUND

The call for Rehabilitation Science and Engineering (RSE) Centers was formalized in "Enabling America" as a result of a request from the U.S. Congress to the Institute of Medicine (Brandt & Pope, 1997). As a result of this text, a group of centers and departments documented the RSE programs in a single issue of *Technology and Disability* in 2000 (Baum, 2000; Cooper & Brienza, 2000; Fuhrer, 2000; Mann, 2000; Ottenbacher, 2000; Seelman, 2000; Walker, 2000; Wood-Dauphinee, 2000). Since the early 2000's these programs have grown to meet the needs of individuals with disabilities through teaching, scholarship and service. During this same period, The Ohio State University and The Ohio State University Wexner Medical Center have developed components of an RSE Center. These components include the development of an Assistive Technology Center, a course on Assistive Technology, a Rehabilitation Engineering Design Program, and a multitude of research activities. The development of an RSE Center will integrate these individual components into a nationally and internationally recognized program that provides the best clinical services, develops leading edge technologies and educates the future leaders in rehabilitation engineering and assistive technology. The purpose of this paper is to describe the proposed development of a

Rehabilitation Science and Engineering Center, using The Ohio State University as a case example.

PAST

The Ohio State University (OSU) and The Ohio State University Wexner Medical Center (OSUWMC) are currently undertaking numerous activities in the field of rehabilitation science and engineering. These activities extend across the core missions of the University: teaching, scholarship and service. The successes of the activities have begun to cultivate a national and international presence as a recognized leader in rehabilitation science and engineering.

Clinical Services

The Assistive Technology Center (ATC) at The Ohio State University Wexner Medical Center was created in 2009 to integrate the assistive technology services that were already in existence but spread out throughout the continuum of rehabilitation services. Furthermore, the Center was created to provide the administrative, educational and external support that is necessary in successfully providing assistive technology services. As a result the ATC has transformed from a clinic with a staff of 4 and providing services two days a week, to a national leader with a staff of 11 providing services 5 days a week. The clinicians in the ATC have presented at national and international conferences, and have created a highly efficient service delivery model that maximizes the resources of the Medical Center, the University and external collaborators (e.g. suppliers and manufacturers) to maximize the performance of individuals with disabilities in the community. The ATC is now a freestanding cost center within the Medical Center, and provides the clinical arm of the RST center.

Teaching

The Rehabilitation Engineering Design Program is a multi-disciplinary capstone program lead by the Departments of Biomedical Engineering, Mechanical Engineering, and the Division of Occupational Therapy (King, 1999). The program provides mechanical engineering, biomedical engineering, occupational therapy, and physical therapy students with the opportunity to design

assistive technology and rehabilitation technology devices based on the real-world need of consumers and clinicians. The program, initiated in 2007, has grown from a single project with 5 students to 19 projects with over 95 students in 2013. Though the primary instructors for the course come from BME/ME/OT, numerous faculty and staff from departments throughout the University and Medical Center participate as subject matter experts to insure the real-world relevance of the project. ABET accredited engineering programs require a capstone design program, however, the continual success of this program is built on the fact that clinical students directly participate in the entire design process for academic credit. The caliber of the final designs is significantly higher than what is typically developed in other programs as is evidenced by the number of awards attained at the engineering expo. This program provides one of the cornerstones for the educational component of the RSE program.

The AT Course is a multi-disciplinary course that provides an overview of assistive technology devices, services, strategies and practices (Crema & Moran, 2012). The course is housed in the Occupational Therapy Division, and has a long history. The course was initiated in and is jointly taught by an Occupational Therapist and a Rehabilitation Engineer. The course leverages the expertise of practitioners in the community through guest lectures, both in person and over the Internet. Though the course is required for all MOT students, numerous non-OT students have completed the course including speech and hearing sciences, physical therapy and mechanical engineering students. This course provides the academic training necessary to become a well-seasoned professional in the field of assistive technology, and meet the criteria necessary to attain the Assistive Technology Professional Certification.

Scholarship

We have leveraged the AT Center as the central hub of the research and development activities with a focus on industry partnerships. The knowledge translation for technology transfer (KT4TT) knowledgebase developed by the University at Buffalo (see <http://kt4tt.buffalo.edu/knowledgebase/>) provides the foundation for the research and development activities (Flagg, Lane, & Lockett, 2013; Lane & Flagg, 2010). We have focused on the research aspects of the Invention Phase (aka Stage 6) with funding from industry in the areas of pressure management and power mobility. An explicit example includes the research of a community based pressure-sensing system with funding from Dynamic Controls¹. Utilizing the KT4TT framework allows the AT Center to better integrate with industry objectives, and therefore bring products to market based on evidence based practice.

We have also leveraged the AT Center through collaboration with the University of Pittsburgh. The project includes operationalizing a patient-reported outcome measures in assistive technology. It is currently in an alpha-testing stage as part of the quality assurance program. The research and development activities with industry and other academic institutions demonstrate the ability to leverage the AT Center as the clinical hub for assistive technology and rehabilitation engineering scholarship. The RSE Center will shape the teaching, scholarship and service mission, by building a research and development program around the AT Center. This will elevate OSU / OSUWMC as a recognized leader in the field of assistive technology, rehabilitation technology and rehabilitation engineering.

FUTURE

The RSE Center will be housed in the School of Health and Rehabilitation Sciences. Given that this is a multi-disciplinary program, faculty and staff from numerous units will be identified and recruited for active participation in the program. Consumers, students, clinicians and researchers to work side by side as partners, which is key to the success of the RSE Center. This can be facilitated by a co-located clinic/lab. The AT Center provides the foundation for a co-located clinic/lab given that clinicians, students, faculty, consumers and external partners (e.g. suppliers and manufacturers), are already working together. The future success of the RSE Center as a collaborative clinic/lab is predicated on the past accomplishments of the AT Center.

Clinical Services

The RST Center will rely on the AT Center as a hub for a teaching, scholarship and service. Given the AT Center already has a well-established model for service delivery (e.g. scheduling, billing, clinical staff), we will leverage the infrastructure for providing new and innovative AT services to individuals who are not currently receiving AT services. Populations of interest not currently served by the AT Center are school-age children working through the individual school systems, post-secondary students at The Ohio State University and other post-secondary institutions located in the region, adults with developmental disabilities working through the county organizations, and individuals in less-resourced settings (eg. Appalachia). Innovative models include new funding models (e.g. fee-for-service) and service delivery models (e.g. tele-rehabilitation, less-resourced settings, community based care system). The key is to identify populations in specific environments that want AT services beyond what is already available to them, and identify service delivery models, which will meet their needs. The ATC will provide the clinical hub to advance the teaching and scholarship pursuits of the RST Center as we develop new and innovative service delivery models.

Given the focus on evidence-based practice, and the need to quickly translate research and development activities into clinical practice, a focus will be placed on training clinician scientists. Residencies and fellowships will be utilized to engage clinicians who are fully engaged in scholarship while carrying a typical caseload within the AT Center. The goal is to train the clinicians as researchers while maintaining their clinical skills. In addition to building the clinician scientists' acumen for research, a focus will be placed on developing the skills, knowledge and expertise necessary for the RESNA Assistive Technology Professional (ATP) and Seating and Mobility Specialist (SMS) certifications.

Teaching

The RSE Center will build on the successes of the RE Design Program and the assistive technology course. Given the success of the RE Design Program, the program will include formal faculty support from other units (e.g. physical therapy and speech and hearing sciences). We will actively recruit students from those units, creating a truly multi-disciplinary program. The RST Center will provide a conduit for recruiting industry partners for participation in the RE Design Program. This will lead to industry sponsorship for some of the projects, and will create a conduit for getting future products to market. A roadblock to the translation of products from the Invention phase (aka development) to the Innovation phase (aka production) is the lack of industry involvement from the initiation of the project ideas. Industry involvement, regardless of their willingness to fund the projects, will increase the educational opportunities for students, and showcase the intellectual and capital resources available at OSU. The ultimate goal focuses on generating intellectual property that could fund future research and development activities. A key partner in developing the RE Design Program is the Technology Commercialization Office (TCO) as a partner in developing and leveraging intellectual property (e.g. patent, license) activities. The RE Design Program provides a mechanism for training future engineers and clinicians, thereby creating capacity for meeting the technology needs of individuals with disabilities.

Accreditation is an important component of any educational program, however, one does not currently exist for the fields of assistive technology or rehabilitation engineering. Therefore, if a professional organization (e.g. RESNA) develops an accreditation process, then The Ohio State University will be well positioned to participate in the development and implementation process. Accreditation will identify the RST Center as a leader in the field, thereby setting the SHRS programs apart from other programs.

Future educational opportunities could lead to the development of other courses in the areas of Rehabilitation Engineering and Assistive Technology similar to the series

of courses that are available at the University of Pittsburgh and the University of Illinois at Chicago. Currently, it is unclear if there is a need for a series of courses that could lead to a certificate or specialization from the University, specifically given the current research specialization in rehabilitation engineering for students in the School of Health and Rehabilitation Sciences. The student populations most interested in the course work (OT/PT/SLP/BME/ME) have a well-defined curriculum with little room for additional courses. Therefore, the current educational opportunities meet the goals for the RST Center, but should be revisited throughout the RST Center maturation process.

Post-professional courses would support the academic and clinical initiatives within RST Center both locally and nationally. The courses would be in the format of continuing education, as opposed to traditional graduate level courses. This would leverage content developed by the RST Center courses. One of the key deficiencies of the field of rehabilitation engineering and assistive technology is the lack of post-professional educational experiences. The on-line courses would directly address this need for individuals seeking the certifications provided by RESNA (ATP, SMS). The course content would eventually transition from the post-professional arena to the pre-professional arena as more and more individuals receive AT and RE training prior to graduation. The post-professional online courses could then transition to a hybrid model for providing a combination of on-line and hands-on education for individuals in fields that do not have pre-professional training. Also, it could directly address the need for technicians in the field. The key to the online education opportunities is collaboration with organizations that have already established online or hybrid models, rather than recreating the wheel and competing with them in the education market. Examples include OSU (Office of Distance Education and eLearning), Ohio Center for Autism and Low Incidence (OCALI), and the University of Pittsburgh Department of Rehabilitation Science and Technology Continuing Education (RSTCE). A joint partnership in this arena would be much more powerful than starting from scratch. OCALI and RSTCE already have the resources in place to deliver both face-to-face and online content.

Scholarship

Research and development is the least developed activity within the RST Center, but has the greatest potential for future expansion. The R & D activities will focus on multi-disciplinary/multi-site opportunities. The areas of focus include assistive technology, rehabilitation technology, outcome measures, and tele-rehabilitation. The research and development opportunities are possible due to the foundation in place through the Assistive Technology Center and the Rehabilitation Engineering Student Design

Program, as well as collaboration among the University and Medical Center stakeholders.

CONCLUSION

The advancement of technology in conjunction with the increase in the number of individuals with a disability predicates the need for academic rehabilitation science and engineering centers. The Ohio State University has the foundation to develop a nationally and internationally recognized RSE center. The center will focus on training, scholarship and service in the fields of rehabilitation engineering and assistive technology. This focus will allow the center to meet the needs of people with disabilities through a multi-disciplinary collaboration, which builds on the success of the Assistive Technology Center. Key to the success of this center is the continued leadership of the RESNA community in identifying and fostering best practices in RE and AT teaching, scholarship and service. The RSE Center will synthesize the numerous rehabilitation engineering and assistive technology activities throughout the university and medical center, thereby creating a synergistic environment to improve the quality of life of individuals with disabilities through the application of science and technology.

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FOOTNOTES

1. Dynamic Controls, Inc., 17 Print Place, Christchurch 8024 New Zealand. www.dynamiccontrols.com