

REHABILITATION ENGINEERS, TECHNOLOGISTS, AND TECHNICIANS: VITAL MEMBERS OF THE ASSISTIVE TECHNOLOGY TEAM

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ABSTRACT

Rehabilitation Engineering is the application of science and technology to improve the quality of life for individuals with disabilities. The rehabilitation engineering profession includes rehabilitation engineers, rehabilitation technologists and rehabilitation technicians. Rehabilitation engineering professionals (REP) collaborate with numerous professionals to meet the needs of individuals with disabilities. REPS have a significant role in the fields of assistive technology, rehabilitation technology and universal design. REPs work in a variety of sectors including service delivery, education, research and development. Given the ever increasing advances in technology numerous opportunities exist for the expansion of rehabilitation engineering. These opportunities can only be met with more educational and training programs throughout the academic continuum. Rehabilitation engineering professionals, as members of a trans-disciplinary team, are necessary to meet the technological needs of individuals with disabilities.

INTRODUCTION

Rehabilitation Engineering is the application of science and technology to improve the quality of life for individuals with disabilities. The rehabilitation engineering profession includes rehabilitation engineers, rehabilitation technologists and rehabilitation technicians throughout the world. Rehabilitation engineering professionals primarily work in the fields of assistive technology (AT), rehabilitation technology (RT) and universal design (UD). As these fields have advanced, so has the role of rehabilitation engineering in health and wellness, educational, social, and vocational frameworks.

Initially, rehabilitation engineering professionals (REP), which for the purpose of this paper includes engineers, technologists and technicians, focused on developing custom design and fabrication of devices in clinical settings. As more AT and RT devices have become commercially available (figure 1), the role of REPs have also evolved. REPs now have a greater role in AT and RT, which include the following areas:

1. customization and integration of existing AT and RT;
2. research, development and production of devices;
3. analysis of human performance; and
4. application of outcome measures throughout the assistive technology service delivery process.

The advancement of the AT and RT fields has lead to a change in the practice of rehabilitation engineering. In order to address this change, the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA), Rehabilitation Engineer and Technologist (RE&T) Professional Specialty Group (PSG) commissioned an ad-hoc committee to generate a white paper that defines the current roles and responsibilities of Rehabilitation Engineers, Rehabilitation Technologists and Rehabilitation Technicians in practice.

CURRENT DEFINITIONS

Though the field has evolved, and numerous definitions for rehabilitation engineering have been described in the literature (Hobson, 1977; Hobson & Trefler, 2000; Kondraske, 2000; Potvin, Mercadante, & Cook, 1980; Reswick, 1983) the simplest and most straight-forward definitions is provided by the IEEE Engineering in Medicine and Biology Society. The definition simply states: "Rehabilitation Engineering is the application of science and

technology to improve the quality of life for people with disabilities.”[6] The definition is eloquent in that it first describes engineering as an activity, and then defines the population for which the activity is applied(Voland, 2004). This clearly identifies the uniqueness of engineering professionals, as opposed to inventors or scientists, and the uniqueness of rehabilitation engineers, rehabilitation technologists and rehabilitation technicians. Utilizing the definitions engineer, technologist and technician found in the Oxford English Dictionary[8]–[10], the following definitions for the Rehabilitation Engineering Professions are as follows

Rehabilitation Engineer is defined as a person who uses specialized knowledge or skills to design, build, and maintain complicated equipment, systems, processes, etc. for individuals with disabilities.

Rehabilitation Technologist is defined as a person who specializes in technology for individuals with disabilities. Often a technologist is equivalent to a technician.

Rehabilitation Technician is defined as a person qualified in the practical aspects of one of the sciences or mechanical arts as it relates to individuals with disabilities.

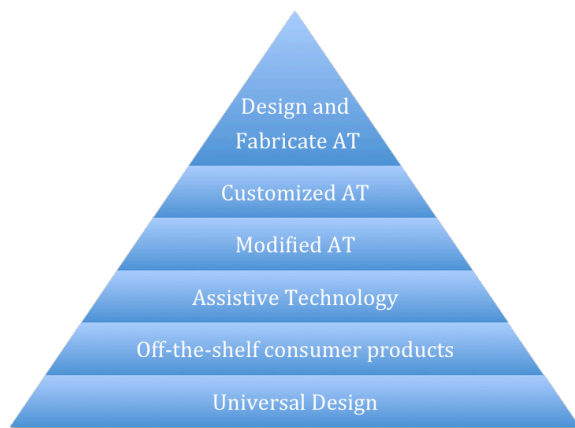


Figure 1. The continuum of assistive technology.

REHABILITATION ENGINEERING PROFESSIONALS IN A TRANS-DISCIPLINARY TEAM

Rehabilitation engineering professionals collaborate with numerous professionals to meet the needs of individuals with disabilities. In order to synthesize the unique characteristics of each individual with a disability, REPs must have an understanding of the roles and responsibilities of each profession (e.g. engineers, clinicians, educators). As with other professional groups, overlap in roles exists across professionals, which is necessary for the transfer of information, and the effective collaboration of a trans-disciplinary team. A trans-disciplinary team is recognized as best practice for

providing assistive technology to individuals with disabilities whether in the healthcare, home, school or vocational setting(Cook & Polgar, 2008; Eggers et al., 2009; Long et al., 2003). Though all of the professionals that work in the field of assistive technology focus on technology, the REP stands out as the professional with the skills, knowledge and expertise in development and application of technology for individuals with disabilities.

REPs are unique in comparison to other engineering professionals in their interaction with individuals with disabilities. No other engineering profession works as closely with children or adults on a daily basis. It is this direct interaction that facilitates the REPs successful integration in the multi-disciplinary team. The unique skills, knowledge and expertise position REPs as key stakeholders in the development of personalized health (Persch, Braveman, & Metzler, 2013), which closely aligns itself with individualized education plans, and individualized work plans in educational and vocational settings.

RESPONSIBILITIES OF THE REHABILITATION ENGINEERING PROFESSIONAL

The responsibility of REPs depends on their knowledge, skills and experience. The Rehabilitation Engineer participates in the full AT service delivery process and will take a lead role in the assessment process, which includes the customization and integration of AT, as well as the analysis of human performance. Furthermore, the rehabilitation engineer directs the training and education of stakeholders on the proper use of AT and RT. The rehabilitation engineer supervises the rehabilitation technologist and rehabilitation technician in the implementation, follow-up and follow-along processes. The rehabilitation engineer also leads the research, development and production activities for manufacturing AT & RT. Finally, the rehabilitation engineer may supervise the AT Centers within different settings (e.g. medical, educational, vocational). This includes the application of outcome measures (performance, user satisfaction, quality of life) as part of a closed-loop feedback system to insure quality throughout the service delivery process.

The Rehabilitation Technologist may supervise rehabilitation technicians to complete tasks required for an individual to use assistive technology. She or he may participate in team meetings about an individual’s assistive technology needs, and assist in training individuals and their team about unfamiliar technology. The rehabilitation technologist will participate in the full AT service delivery process, but typically will not take a lead role. She or he will provide continuity for the implementation of appropriate AT. They will also play an important role in supporting research and design, as well as manufacturing.

The rehabilitation technician works under the guidance and supervision of a rehabilitation technologist or

rehabilitation engineer. His or her interaction with clients focuses on the set-up, adjustment and repair of equipment during the implementation, follow-up and follow-along phases of the service delivery process. Rehabilitation technicians also play an important role in supporting AT and RT production.

TRAINING OF THE REHABILITATION ENGINEERING PROFESSIONAL

While some rehabilitation engineers have master’s degrees in rehabilitation engineering, most rehabilitation engineers have undergraduate or graduate degrees in biomedical engineering, mechanical engineering, or electrical engineering. Their academic training includes formal training in principles of design, ergonomics, biomechanics, mechanical and electrical systems, material sciences and life sciences. They also gain an understanding of the functional capabilities and prognosis of people with various disabilities.

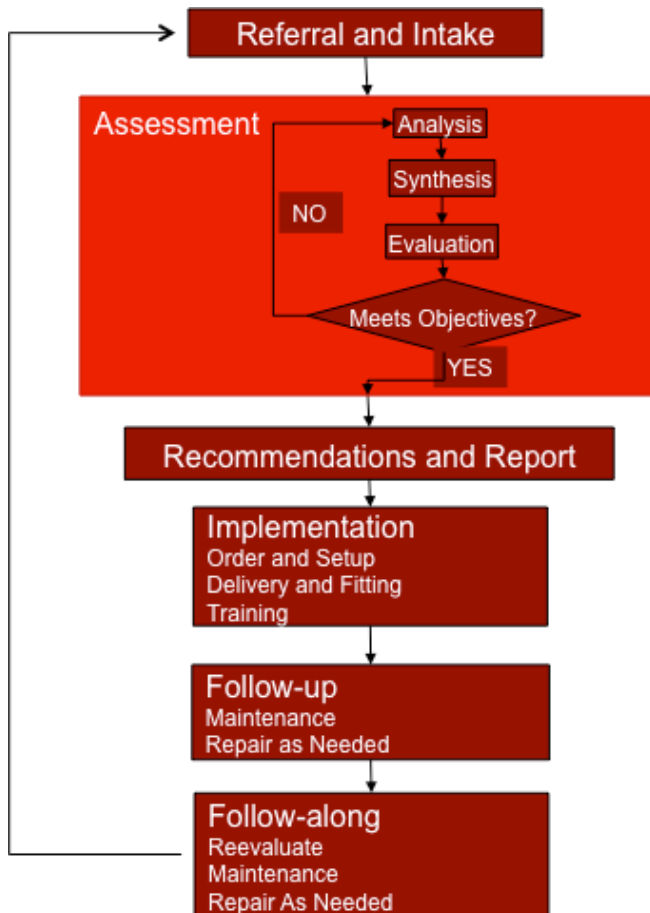


Figure 2. Assistive Technology Service Delivery Process as described by Cook and Polgar (Cook & Polgar, 2008) and Szeto (Szeto, 2001).

Rehabilitation technologists have associates, undergraduate or graduate degrees in health and rehabilitation sciences such as nursing, counseling,

psychology, biological sciences, computer science, occupational therapy, physical therapy, speech therapy and engineering. Their professional training focuses on non-engineering degrees with a minor (or equivalent) in engineering and technology coursework.

The rehabilitation technician usually has a diploma from a vocational school in areas such as computer technology, industrial electronics and machine tool technology. The rehabilitation technician usually gains knowledge of working with people with disabilities through mentorships or apprenticeships at rehabilitation facilities, durable medical equipment providers or vocational rehabilitation agencies. The rehabilitation technician may eventually qualify for the role of the rehabilitation technologist through several years of apprenticeship as a rehabilitation technician and demonstrating competency through a credentialing program (e.g. Assistive Technology Professional certification).

FUTURE OF EDUCATION AND TRAINING

As the field of Rehabilitation Engineering advanced through the late 1970s and 1980s, most notably with the start of the Rehabilitation Engineering Society of North America (RESNA) in 1979, so did opportunities for education and training. A call for education and training in rehabilitation science and engineering was described in 1997 in “Enabling America”(Brandt & Pope, 1997). In this book, the authors make four recommendations, one of which is increasing doctoral and postdoctoral education “...to help encourage the development of the field and respond to the expanding research needs.” Therefore, the education and training opportunities have primarily focused on activities surrounding the Rehabilitation Engineering Research Centers, which continues today. Furthermore, in 2000, an entire issue of Technology and Disability was devoted to the field of rehabilitation science and the role of graduate education. The articles focused on masters and doctoral level education, as well as opportunities for collaboration between the Schools of Engineering and Health and Rehabilitation Sciences (Cooper & Brienza, 2000; Mann, 2000). Though the articles focused on graduate education, their emphasis often impacts the development of undergraduate education. As technology translates from the research and development stages to full-fledged consumer products, there will be an increased need for rehabilitation engineering professionals.

As the field of rehabilitation engineering develops through grassroots efforts, formal opportunities for REP training programs will develop through academic and apprenticeship programs. Traditional programs in the rehabilitation engineering professions do not currently exist at the undergraduate level. However, the principles of rehabilitation engineering are incorporated in existing engineering and engineering technology programs, most notably in the health sciences and engineering fields.

Considering the associates degree, an opportunity exists for training rehabilitation technologists and rehabilitation technicians through existing community colleges. Furthermore, considering the bachelors or professional degree in health sciences, an opportunity exists for training rehabilitation technologists through existing health science programs. Finally, at the level of the bachelors or masters degree in engineering, an opportunity exists for training rehabilitation engineers through existing engineering programs (Figure 3). Therefore, even though formal educational programs in rehabilitation engineering do not currently exist, numerous opportunities for specializing in the rehabilitation engineering professions are currently available within multiple engineering and health science disciplines through community colleges and universities. In the future, these opportunities may turn into dedicated training programs within the Engineering and Rehabilitation Sciences curricula.

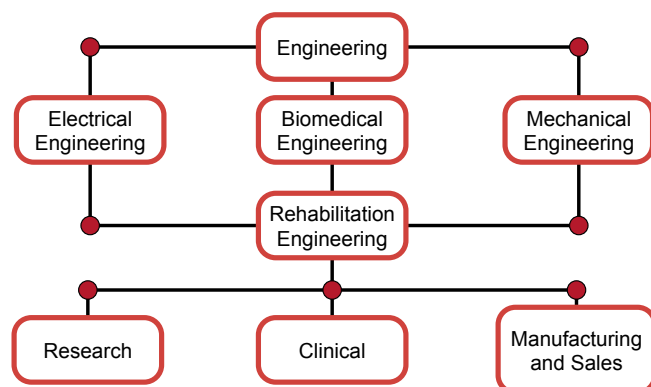


Figure 3. Example engineering educational programs that feed into RE, and the associated areas of employment.

CONCLUSION

The purpose of this paper is to define rehabilitation engineering and the roles, responsibilities and training for rehabilitation engineering professionals. We define rehabilitation engineering as the application of science and technology to improve the quality of life for individuals with disabilities. The individuals that work in the field of rehabilitation engineering, also known as rehabilitation engineering professionals (REP), include rehabilitation engineers, rehabilitation technologists and rehabilitation technicians. The REPs are a critical member of the trans-disciplinary team that provides assistive technology services. REPs work in a variety of sectors including service delivery, education, research and development. Given the ever increasing advances in technology, the aging population, and the increase in the number of individuals with a disability, numerous opportunities exist for the expansion of rehabilitation engineering. These opportunities can only be met with more educational and training programs throughout the academic continuum. REPs will be necessary to meet the technological needs of individuals with disabilities.

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