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Ways of Knowing that Inform Scholarship:

Rehabilitation Engineering as a Discipline

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The goal of this paper is to look at rehabilitation engineering as discipline and a *way of knowing*. I believe that through my research, I have found evidence to support the premise that the discipline of rehabilitation engineering more strongly follows a *medical model* of service delivery to individuals with disabilities, than a *social or participation model* of services delivery, and that this practice shapes the field in many important ways. I will explore the ways of knowing prevalent in the field of rehabilitation engineering through literary research and personal communications with professionals in the field. My research methods included: (1) gathering information on both the medical and social models of service to individuals with disabilities, (2) conducting interviews with two professionals in the field working directly with individual with disabilities, and (3) critiquing research projects conducted by individuals in the area of rehabilitation to determine the scope of inquiry and research methods. ✓

Medical Model vs. Social Model of Service Provision

The medical model of disability services regards a disability as a deficit or sickness, which must be cured through medical intervention (Kaplan). The way of thinking or knowing in the medical model is to diagnose the illnesses, discover their causes and symptoms and design treatments aimed at curing the illness or elevating the symptoms. (Duchan, 2001) ✓

In contrast, a social model or what sometimes is referred to as the “participation” model is less interested in the cause of a disability or illness. It focuses on how a disability effects a person’s life (Duchan, 2001). The social model regards the disability as “a normal aspect of life, not as a deviance and rejects the notion that persons with disabilities are in some inherent way defective.” (Kaplan) ✓

The attitudes and services under the medical and social models are very different.

Table 1, outlines the differences of the two service provision models based on both how the individual receiving services is viewed and how the “problem” facing the service provider is defined.

Table 1
 Comparison of the Medical and Social Model of Service Delivery

	Medical Model & Rehabilitation Paradigm	Social or “Participation” Model & Disability Paradigm
Definition of Problem	Physical or mental impairment; lack of abilities	Dependence upon professionals, family members and others; it is the attitudes and environments that are hostile and need fixing
Locus of problem	In the individual (individuals are sick and need to be “fixed”)	In the environment; in the medical and/or rehabilitation process itself; Disability is a common part of the human condition
Solution to the problem	Professional intervention; treatment	<ol style="list-style-type: none"> 1. Civil rights & advocacy 2. Barrier removal 3. Self-help 4. Peer role models and peer support 5. Consumer control over options & services
Social role	Individual with a disability is a “patient” or a “client”	Individual with a disability is a “consumer” or “user” of services and products
Who controls	Professional	“Consumer” or “individual”
Desired outcomes	Maximum self-care Gainful employment	Independence through control over ACCEPTABLE options for everyday living in an integrated community

Developed by Gerben DeJong in 1978 adapted by Maggie Shreve and Jane Isaacson Kailes, 2002
 (www.jfk.com/itcpara.html)

*quest
 made, all
 self-help
 has.*

To gain a complete understanding of these two methods of service provision, the medical model and the social model, it is necessary to understand the philosophies that guide them. For example, as illustrated in the chart above, the medical model sees the person with a disability as a “patient” or “client”. The client has a problem. The service provider is there to solve the problem or, at the very least, alleviate as many of the symptoms as possible. The medical model incorporates a number of professionals, physicians, physical therapists, occupational therapists, rehabilitation engineers etc., each typically conduct their own evaluation of the “problem” and formulate a solution, which they present to the “patient”. (Duchan, 2001) This paradigm follows the framework of normal science as defined by Kahn (1996).

In the social model, the service provider understands the need to empower the “consumer”. These service providers advocate that the consumer believe that they can initiate and carry out activities on their own; this is what Brunner refers to as “agency” (1996, p 35). The social model uses the development of agency as a tool that can be used by the consumer to tackle any obstacle that may enter into their path. Teaching self-advocacy and fostering self-determination allows the individual to move beyond what may be in their immediate environment. In chapter six of the *Culture of Education*, Brunner discusses the importance of having a premise or structure from which to build further knowledge. He states, “‘something generic’ is what I used to call the ‘structure’ of a subject, the knowledge that permitted you to go beyond the particulars you had already encountered.” (1996, p129) The social model of service understands that it is not enough to solve today’s problems; the consumer must have the ability and skills to solve tomorrow’s problems as well.

Rehabilitation Engineering as a Discipline

Where does the discipline of rehabilitation engineering fit into these two models of service? The definition of the discipline is a good place to start. Although there is a national organization for rehabilitation engineers, RESNA (Rehabilitation Engineering Society of North America), and several programs of study in the area of rehabilitation engineering, including one at the University of Virginia, rehabilitation engineering is not yet considered a profession! (Irwin, 1998) *Interesting... I didn't know that.* Given this unavoidable truth, the discipline of rehabilitation engineering has been defined by the founding president of RESNA in the following way. "The application of science and technology to improving the quality of life of persons with disabilities." An engineer applies the principals of science mathematics and technology to solve problems. He goes on to say that rehabilitation engineers are engineers of any profession who practice rehabilitation at any place and at any time." The emphasis on science and problem solving in this definition is consistent with the paradigm that guides the *medical model*. It also held true to the information I received from the two Rehabilitation engineers I interviewed. ✓

I spent several hours at National Rehabilitation Hospital in Washington DC interviewing two rehabilitation engineers. The main objectives of the interview was to learn more about what drives them to continue in the discipline, what paradigms were predominant in the field in regard to research and direct service provision, and what skills were necessary to be successful in the "profession" (A list of the specific questions asked are located in appendix A). I interview two individuals, Rich, Justin. The interviews were done simultaneously in an informal fashion. Although both Rich and Justin are considered rehabilitation engineers, neither of them have formal training from a

rehabilitation engineering program. Rich holds a degree in Industrial engineering; Justin has a bachelor's degree in mechanical engineering and a master's degree in biomedical engineering. They did not set out to work with people with disabilities. What attracted them to the field was the unique application of engineering principals.

Kind of a paradigm shift in program!

The two gentlemen were very interested in open to answering my questions.

They genuinely wanted to share information about their profession and spoke enthusiastically about what they were doing for a living. When asked what skill was needed most to be successful as a rehabilitation engineer, I was surprised by the response. They barely hesitated and said, "The ability to problem solve." A good rehabilitation engineer, according to Justin, has a logical mind. He added that in the environment they were in, a rehabilitation hospital, the ability to communicate with medical personnel was helpful since there was a lot of coordination between rehabilitation engineers and medical professionals such as physicians, physical therapists and occupational therapists. I was surprised that mathematical skills did not come up in the conversation so I specifically asked if they found themselves using complex mathematical knowledge. They both confidently said no. The computers do all of that work. Again, logic and problem-solving skills were reiterated (personal communication, 2002).

What drives Rich and Justin to continue in the field was not primarily to help people with disabilities, but rather a nagging need "to know how to make something work". Not to say that Rich and Justin do not enjoy helping people with disabilities. They came across as very compassionate and enthusiastic (personal communication, 2002).

Although they work directly with clients, they are very involved in conducting research. It appeared to be a main job function. Every client's progress is painstakingly documented with quantitative data. (This will be explained in more detail in the discussion of research projects.) In many situations, the data is the driving force behind making adjustments to the clients program, although the clients voice is always heard. Justin noted that although that he and Rich and the other rehabilitation engineers are highly scientifically oriented, they do not forget the client. They believe in the saying, "Nothing about me without me." He said that no matter what the data says, the people have a way of "keeping it real."

→ It's that a more like a social model, yes.

It is obvious that Rich and Justin are all very much committed to the clients that they serve and are undoubtedly enjoy helping people with disabilities, I was struck by the fact that ~~the fact~~ ^{the fact} that they were working with people with disabilities was rarely, if at all, mentioned. I am quite sure that if I interviewed special educators or assistive technology specialists the responses would be markedly different. Most of the special educators I know got into the field because of a connection with someone who has a disability. If you ask a special educator what drives them to stay in the field, more than half would mention helping people with disabilities to succeed. I believe that the responses I received from these rehabilitation engineers demonstrate a fundamental difference in ways of knowing between educators who generally employ the social model of service provision, and engineers who I believe employ a medical model.

Research Topics and Methodology

National Rehabilitation Hospital is involved in a number of different research projects in the area of rehabilitation engineering. I was given a tour of the facilities where

I think you are right, but given your interview a little question, would you see it as merely medical vs. social model? It's a little blurry, so maybe we should clarify.

the research is taking place. The three projects I examined were, (1) Wired Independence Square, (2) The Interactive Video Exercise System and (3) Rehabilitation Telemonitoring. Although they are three very different projects, they share some fundamental similarities that give clues to the overall *way of knowing* in the field of Rehabilitation Engineering. The three projects are briefly described in the following paragraphs.

Wired Independence Square is an area within National Rehabilitation Hospital (NRH) that represents areas of daily living in a true-to-life-form. There are four areas included in Wired Independence Square, a kitchen, gas station, complete with an actual car and gas pump, a grocery store and a pharmacy. In the kitchen environment sensors have been installed on all doors, and knobs that control the operation of appliances such as the stove microwave, etc. These sensors are designed to take objective data of a patient's performance of daily living tasks such as preparing a cup of tea. For example, the sensors record how long the patient keeps the door to the cabinet open or how long the burner to the stove remains turned on. This information is sent automatically to a computer and is compiled. The rehabilitation engineers work with therapists to make changes to the way the data is recorded and displayed to meet the needs of each patient. According to Justin, the principal investigator of the project, the project was designed to provide objective data to physical therapists and occupational therapists to help document a patient's progress (personal communication, 2002). *Wow.*

The Interactive Video Exercise System is another project. Dang identifies two goals of the project, "(1) to develop a motivational video game based exercise program for pediatric rehabilitation, and (2) to develop a low cost, reliable, and objective way to

provide therapists with a device to measure muscle performance” (1998). The system works through applying electrodes to the muscles that therapists wish to strengthen. These electrodes interface with the computer and act as the controls for the patient. By completing muscle-strengthening exercises, such as lifting a leg or arm, the patient is able to control the video game. Quantitative data is collected simultaneously for the therapist (Dang, 1998).

Finally, the Rehabilitation telemonitoring project is aimed at providing continued rehabilitative services to a patient after being released from NRH. The project revolves around devices called a Personal Augmentation Devices (PADs). PADs are designed to provide objective data representing the functional skills of client in his or her natural environment in an unobtrusive manner. It does this by incorporating the type of technology found in wired independence square located at NRH, in the patient’s home. In addition, it allows clinicians to provide just-in-time instruction and consultation through video conferencing technology. (For visuals of Wired Independence Square, the Interactive Video Exercise System, see Appendix B.)

As you can see these projects are very different from one another. However they have many things in common. There are two overwhelming trends observed in rehabilitation research projects, (1) the collection of quantitative data and (2) the inclusion of real environments to teach daily living skills.

It is surprising that so much emphasis is placed on quantitative data in the field of rehabilitation engineering. This reality strengthens my argument that rehabilitation engineering employs a medical model of service. Practitioners in the studies identify a problem, in the example of the Wired Independence Square project; the problem

identified was lack of data to support patient progress with daily living skills (DLS). The solution was to employ technology to gather quantitative data. In the discussion of the projects with rehabilitation engineers, the people with disabilities were always referred to as patients and or clients (see table 1). The desired outcome of this project was to ensure “maximum self care” (medical model, see table 1), as apposed to aiming for a more qualitative measure of “independence”, social model, see table 1). *Integrity*

Although the field of rehabilitation engineering appears to be that of a normal science, the social science and humanities are also very evident. All projects appear to stress the need for the patient to be in a true to life environment and to be as unobtrusive as possible as discussed in the telemonitoring project. Although this project collects quantitative data, it also incorporates video as a way to observe progress in a much more qualitative and subjective manner. Finally, I was impressed by the attention the rehabilitation engineers placed on patient motivation when designing the interactive video exercise system. This system again collects quantitative data. However, in this project attention was also placed on the environment where physical therapy typically takes place. The environment was adapted to more closely match a child’s *way of knowing*, to determine if it would improve performance. Changing the environment rather than the child is consistent with a *social model* of service provision. Above all, I think all of these projects demonstrate an *outside of the box*, and *forward thinking*, way of *knowing*. ✓

Functional Outcomes of the Medical and Social Models of Services

Rehabilitation engineers and rehabilitation hospitals and/or centers are often called upon to complete assistive technology evaluations. There are a number of ways to

complete an assessment for assistive technology. Behrmann, explored three different assistive technology assessment models to examine the effectiveness of each model by looking at outcomes (1994). This paper offers a lot of information about the *ways of knowing* in the fields of education and rehabilitation and further supports the premise that rehabilitation engineers employ a medical model of service. In the study, Behrmann & Shepis, looked at three models of assistive technology assessment, (1) a multidisciplinary evaluation in both a school environment and rehabilitation center, (2) a video screening assessment and (3) an assessment through a job coach. The video screening and job coach method of assessment were employed in a situated environment. To gain a better understanding of the methods and *ways of knowing* of the field of rehabilitation, I focused on the outcomes of the first method of assessment, a multidisciplinary approach in both the educational and rehabilitation setting. Although Behrmann and Shepis initially identified the multidisciplinary approach as one method of evaluation, they did specifically address differences in the approaches and outcomes of both the school and rehabilitation center environments (1994).

In the school environment, although the process was labeled multidisciplinary, it was also very much a trans-disciplinary approach. Occupational therapists, physical therapists, teachers, assistive technology specialists, etc., worked together to both gather information and formulate solutions. In contrast, at the rehabilitation center, a multi-disciplinary team was used, however each member of the team evaluated the individual separately and prepared a report. The assistive technology specialist was charged with making final recommendations. It was also noted that many team members at the rehabilitation center recommended more evaluation before they could make appropriate

recommendations (Behrman & Shepis, 1994). This observation, supports what I had experienced at NRH. The need for complete documentation of supporting quantitative data on a client was required before recommendations were made. This is a paradigm supported in the field of rehabilitation engineering. Educators employ a more qualitative social approach.

Impact on My *Way of Knowing*

I look at the world through the lens of an independent woman, an educator and a person with a disability. It is natural for me to approach working with people with disabilities from a social paradigm. What drives me is compassion for all people and a need to help people reach their potential and be happy. ✓

I was not surprised to learn that rehabilitation engineering, at least in the hospital setting, uses a more medical paradigm to provide services. I was surprised however; to learn that what drives many people into the field of rehabilitation engineering is **not** primarily to help people with disabilities. *That is interesting.* The motivation is often more challenge and application of engineering principals to the complex problems people with disabilities face. The satisfaction of helping people with disabilities was certainly there, but secondary to the adrenaline rush they get from solving a unique problem. Rehabilitation engineers must take risks and think outside the box. I also believe that rehabilitation engineers are by nature more objective than subjective in their thinking, simply due to their inclination and education in the natural sciences.

I began the exploration into the rehabilitation with a negative feeling towards the philosophies that guide the medical model of services to people with disabilities. I believed the practice to be ineffective. At the completion of this paper, I remain an avid

supporter of the social model. However understand why rehabilitation centers and hospitals still use the model. I also appreciate the benefit of having objective measures of performance, but I am gratified to observe the migration of rehabilitation engineering field towards the social model of service provision. This trend was evidenced in some of the research projects discussed. It was also highlighted by the motto Justin shared with me "Nothing about me without me" (Personal communication, 2002).

Indeed.

Great job. It seems you have captured a discipline in the middle of paradigm shift. It sounds like rehab engineering will end up with the best of both worlds.

It would be interesting to take the same research question and analyze how it would play out from a rehab vs. social perspective. What do you think?

Disciplines of perspective	4/6
Use of interview	6/6
Research	
Time to write	5.5/6
Scholarship/Qualifying	
Very of history	5.5/6
Limit to reading	
Writing style	5/6
Research	
Research	
Research	
	27.5/36

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Appendix A

Interview Questions

Professional Preparation

1. What type of coursework prepared you for the field of Rehab Engineering?
 - a. What coursework is most helpful in what you actually have to do on a typical day?
2. What type of person, personality profile do you think is best suited for this field of study and why?

Research Interests

3. As a Rehabilitation Engineer, what type of research projects have you been involved in?
4. What assumptions did you form before beginning that research?
5. What paradigms are present in the field of Rehabilitation Engineering?

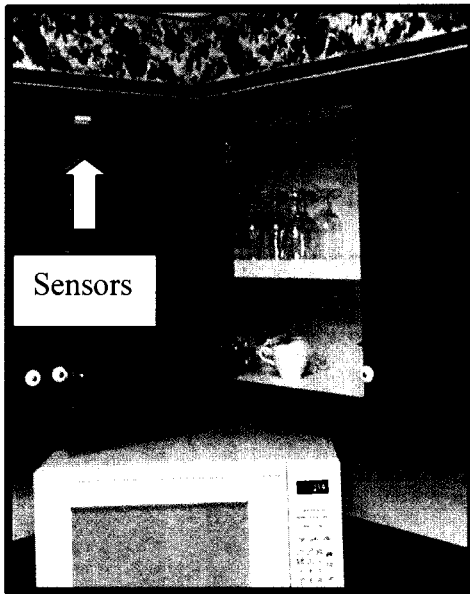
Direct Service Provision

6. How do you approach the provision of direct services to clients?
7. What do you think are the most important aspects of a successful rehabilitation experience?

Appendix B

Visuals of Devices Created for
Rehabilitation Engineering Projects

Wired Independence Square



The Interactive Video Exercise
System

