

## KT4TT: Knowledge Translation Embedded in Technology Transfer

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*This FOCUS Technical Brief provides examples of how technology-focused grantees funded by NIDRR, such as Small Business Innovation Research projects and Rehabilitation Engineering Research Centers, can embed knowledge translation efforts throughout the technology transfer process. This issue also describes the Product Utilization Support and Help (PUSH) Award in a broader context of knowledge translation.*

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The National Institute on Disability and Rehabilitation Research (NIDRR) funds the Center on Knowledge Translation for Technology Transfer (KT4TT) to support grantees in the priority area of Technology for Access and Function. KT4TT refers to using knowledge translation (KT) theory and practice in research and development to more effectively apply technology transfer (TT) processes and generate TT outputs.

NIDRR and its grantees are held accountable for generating two forms of outputs—conceptual knowledge and tangible products—which other stakeholders then apply to produce positive outcomes for targeted beneficiary populations. The Center on KT4TT's goal is to increase the application of NIDRR grantees' outputs by a variety

of stakeholders—including manufacturers, clinicians, researchers, policymakers, brokers, and consumers—thereby increasing TT outcomes that will benefit the quality of life for people with disabilities.

This and subsequent *FOCUS Technical Briefs* will provide examples of how technology-focused grantees funded by NIDRR, such as Small Business Innovation Research<sup>1</sup> (SBIR) projects and Rehabilitation Engineering Research Centers<sup>2</sup> (RERCs), can embed knowledge translation efforts throughout the technology transfer process. This issue also describes the Center on KT4TT's Product Utilization Support and Help (PUSH) Award (see page 7) in a broader KT context. The first PUSH Award winner, CreateAbility Concepts, Inc. (CCI), utilizes exemplar processes, which are described as well.

1. Small Business Innovation Research (SBIR) grants encourage the development of new ideas and products useful to people with disabilities and the rehabilitation field. This three-phase program takes an idea from development to market readiness (National Rehabilitation Information Center, 2010).
2. Rehabilitation Engineering Research Centers (RERCs) conduct programs of advanced research of an engineering or technical nature to develop and test new engineering solutions to problems of disability. Each center is affiliated with a rehabilitation setting, which provides an environment for cooperative research and the transfer of rehabilitation technologies into rehabilitation practice. The centers' additional responsibilities include developing systems for the exchange of technical and engineering information and improving the distribution of technological devices and equipment to individuals with disabilities (National Rehabilitation Information Center, 2010).

## Start at the Beginning

Optimally, planning for knowledge translation should occur at the beginning of the grant cycle before any research is conducted. Quoting Stephen Covey (1989, 2004), “Begin with the end in mind.” This issue of *FOCUS* provides examples of NIDRR technology grantees that have carried out work encompassing *research* and *development* in order to generate a *product* in the marketplace for people with disabilities.

From the start, grantees need to seek to understand the KT requirements of the various stakeholder groups in their technology area. Doing so helps ensure that their work, be it research or development, will improve people’s lives. In this brief, we examine the use of knowledge translation for technology transfer to address consumers’ needs. The needs of other stakeholder groups will be covered in future issues.

To address the KT requirements of consumer groups, researchers need to involve consumers early on in the process to understand their specific needs. While a researcher may think he or she knows what research or product void exists, only consumers can truly identify and describe the requirements for filling that void, if it does exist. In some cases, grantees have had to recognize that consumers sometimes prefer a technology-free option. Effective consumer involvement is demonstrated in real-life examples from SBIR and RERC grantees.

### Example of Consumer Involvement: NIDRR SBIR Grantee

The first recipient of the KT4TT’s PUSH Award, CreateAbility Concepts, Inc. (CCI), provides a model of exemplary knowledge translation for technology transfer practices as a NIDRR-funded SBIR–Phase II grantee. CCI wanted to produce the HearingCompanion, “a portable device capable of recognizing distinguishable sounds in the environment and communicating this



Source: CreateAbility Concepts, Inc. Logo, Indianapolis, IN: CreateAbility Concepts, Inc. (CCI). Copyright 2011 by CCI. Reprinted by SEDL/National Center for the Dissemination of Disability Research with permission.

information to a user via imagery, vibration, and text through their mobile communications device” (Center on Knowledge Translation for Technology Transfer, 2010).

CCI performed exemplary work in the following three areas:

1. Identifying an unmet need for a technology-based solution to improve the quality of life for persons with disabilities, and differentiating between the need to generate new knowledge from research and the need to demonstrate feasibility through a prototype device.
2. Involving individuals representing the target beneficiary group in the articulation of needs, the translation of those needs into device specifications, and the testing of prototype models for usability.
3. Collaborating with another NIDRR technology grantee with related expertise in the application area and access to consumers with an interest in the envisioned device as a solution to an unmet need.

First and foremost to ensure success, CCI partnered with another organization to acquire the needed expertise it lacked. The collaboration was with Assistive Technology Partners (ATP), a Colorado-based NIDRR grantee with related experience in the application area and with access to consumers in the device target population.

This partnership provided several advantages. Because of the limited amount of time and funds available with the SBIR–Phase I award, CCI did not want to reinvent the wheel when it came to consumer involvement. ATP is nationally recognized for services that include assistive technology assessment and training for individuals with a broad range of communication impairments, including hearing impairment. In addition to its large database of individuals who are deaf or hard of hearing, ATP has extensive experience with small businesses in this area of application and has previously assisted CCI in performing product testing on five other technology-based products (<http://www.assistivetechpartners.com>).

The next process where CCI excelled was to identify an unmet need for a technology-based solution for persons with disabilities. As part of this process, CCI also had to decide whether there was a need for new knowledge or if they could demonstrate feasibility through a prototype device using existing technology.

CCI performed a *requirements analysis*—activities to learn more about the attitudes and strategies of people who are deaf or have hearing impairments and what methods or devices they use to detect and identify sounds at home or at work. These activities included the following: face-to-face meetings with potential consumers, phone interviews with hearing professionals, and an in-depth literature review of available wireless communication and signal processing technologies useful in meeting consumer needs. Results of this literature review showed a sufficient foundation of technology-based research knowledge, so there was no need to allocate time to a research phase. CCI next developed the initial system requirements and identified existing technologies to address those requirements. CCI identified Bluetooth as the best wireless communication approach and selected Linux for the prototyping environment.

To involve consumers and articulate the needs of the target population, ATP conducted (on behalf of CCI) a mixed focus group composed

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*HearingCompanion is an application that runs on the Nokia® N900 (shown on the left) and many versions of Android phones, such as the HTC Desire (right). On the right is a listing of recent sound events and the time each occurred, with the most recent at the top of the list.*

**Figure 1. Nokia N900 and HTC Desire cell phones with the HearingCompanion app. in use.**



Source: *HearingCompanion*, Indianapolis, IN: CreateAbility Concepts, Inc. (CCI). Copyright 2011 by CCI. Reprinted by SEDL/National Center for the Dissemination of Disability Research with permission.

of individuals who were deaf or had profound hearing loss to discuss the functionality, usability issues, reliability requirements, and performance of a device like the HearingCompanion. In other words, consumers were asked to identify the design functions and features they wanted and needed, which were translated into device specifications. CCI then used those specifications to design and build the prototype (see Figure 1 on page 3).

To test the usability of the prototype models, ATP recruited 14 participants. First, the participants' hearing was tested on an audiometer. Next, participants used the HearingCompanion to detect recorded auditory events that were presented. Participants then answered quantitative and qualitative questions to rate their satisfaction with the device's features. Ratings for 12 usability characteristics were assessed. Participants also offered suggestions for improving the HearingCompanion, such as the ability to integrate it with other devices and to customize features.

As a 6-month SBIR–Phase I grantee, CCI produced a functional and tested prototype device by leveraging available time and funding to its fullest and by involving consumers from the start. CCI's collaboration with an experienced NIDRR grantee leveraged available resources by drawing on ATP's expertise in the technology area and its networks with targeted consumers. Including consumers throughout the design process—in the identification and validation of functional needs, in the specification of system requirements, in the testing of prototype

performance, and finally in usability analysis—ensured that CCI's final device was designed for potential customers.

The KT4TT staff found that CCI had incorporated best practice product development processes into its SBIR–Phase I and embedded knowledge translation processes throughout. These actions have improved CCI's ability to communicate its project results to all stakeholders. For example, CCI learned the best terms and phrases to use to communicate its results to its intended consumer audience. CCI also included clinicians early on in the process through phone interviews. This action enabled CCI to gain the clinicians' perspective. By combining this perspective with that of consumers, CCI is able to present its findings in a way that clinicians can more easily and effectively assimilate.

Technology grantees need to identify what information is needed and in what form and format to provide it to enable various stakeholder groups (manufacturers, clinicians, other researchers, policymakers, brokers, and consumers) to use or apply the outputs.

### **Example of Consumer Involvement: RERC**

Diane Bryen, PhD, of Temple University, works with the RERC on Communication Enhancement (AAC-RERC). Dr. Bryen found that individuals who use augmentative and alternative communication (AAC) and their families have increased expectations for life after high school, including attending college, becoming employed, managing personal assistance services and transportation, and having intimate

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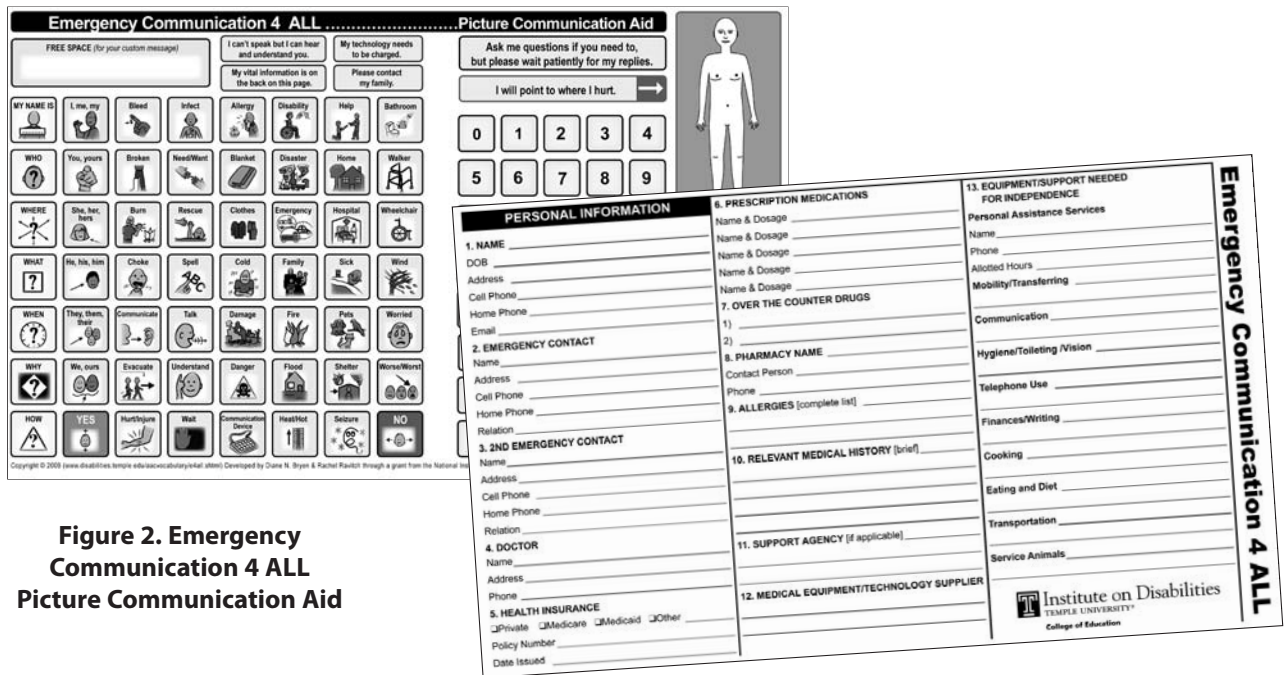
relations. To participate more fully in such social roles, people with severe communication disabilities need augmentative and alternative communication strategies and products to assist them. However, the many AAC products and resources that are available address mainly the needs of children up to the age of 19 and have neglected adults over that age. The vocabulary needed to support socially valued adult roles is frequently not available in pre-programmed AAC devices or in commonly used visual symbol systems.

Dr. Bryen recognized this product void and proposed developing solutions to rectify the situation. Working with people with disabilities as well as caregivers and clinicians, the researcher produced eight evidence-based vocabulary sets that are meaningful in situations and environments encountered by adults.

How did Dr. Bryen involve consumers early on in this process? She recruited AAC technology users to participate in 16 online consumer focus groups, which were used to generate the needed

words for each of the eight vocabulary sets. From these eight vocabulary sets, discrepancy analyses were conducted to determine whether graphic symbols or symbol combinations in each of the two commonly used symbol sets could represent those words. Through these actions, Dr. Bryen embedded knowledge translation throughout her process of research and development. While conducting her research, she kept in mind that the purpose of her work was to improve the lives of people with disabilities, and she sought out ways to make the information useful to consumers.

Furthermore, Dr. Bryen realized she needed to publicize the results of her work and provide them in a format consumers could easily access and use. At conferences, she and her colleagues from both the AAC-RERC and Temple University's Institute on Disabilities make sure they promote the availability of the vocabulary lists and symbol systems to consumers. They also widely distribute consumer-oriented materials on AAC at conferences and on the Temple University Web site to provide easy access for consumers with disabilities.



**Figure 2. Emergency Communication 4 ALL Picture Communication Aid**

Source: *Emergency Communication 4 ALL*, by D. N. Bryen and R. Ravitch, 2009, Philadelphia: Temple University, The Institute on Disabilities, the College of Education. Copyright 2009 by Temple University. Reprinted by SEDL/National Center for the Dissemination of Disability Research with permission. Retrieved from <http://www.temple.edu/instituteondisabilities/aacvocabulary/e4all/EprepPictureAid.pdf>. The Picture Communication Symbols ©1981–2010 by Mayer-Johnson LLC. All Rights Reserved Worldwide. Used by SEDL/National Center for the Dissemination of Disability Research in compliance with permission covered for informational purposes to supplement content as outlined at <http://www.mayer-johnson.com/pcs-information/>.

Dr. Bryen's involvement with consumers didn't end there. She also wanted to communicate the final results of her work to people with disabilities to ensure that they could benefit fully from her efforts. To do so, she developed an Emergency Communication 4 ALL board for AAC users (see Figure 2 on page 5). She has made the board available in English, Spanish, and Haitian Creole and has widely distributed it to consumers and assistive technology professionals through Temple University's Institute on Disabilities Web site (<http://www.temple.edu/instituteondisabilities/aacvocabulary/>).

### New PUSH Award Nominees

In the near future, KT4TT staff will be identifying NIDRR technology grantees for new PUSH Award nominees. For these upcoming awards, staff will be seeking the following:

- Grantees employing the best practice of involving manufacturing companies early on in the development process of their projects
- Grantees who leverage resources available from their host institutions to the fullest extent possible
- Grantees who beta test their prototypes with consumers prior to market introductions

The first two items refer to organizations that are pairing their research strengths with those of businesses and their host institutions. For example, if a university-based RERC needs to develop contextualized knowledge packages for

distribution to manufacturing stakeholders, it may not have expertise within its grant staff to develop a business case, perform market assessments, or conduct prior art or patent searches. However, by leveraging the resources available from their university technology transfer office (TTO), grantees can have the TTO perform those tasks that are within its area of expertise.

The third item refers to organizations that beta test their prototypes with consumers to increase the likelihood that the initial production run of a product meets consumers' needs and expectations. Beta consumer testing enhances the probability of a product's market success.

### For More Information

For more information on the PUSH Award and the first recipient, please visit the KT4TT Web site (<http://kt4tt.buffalo.edu>) and read the *KT4TT Update* newsletter, Volume 2, Issue 1 ([http://kt4tt.buffalo.edu/publications/kt4ttupdate2\\_10.pdf](http://kt4tt.buffalo.edu/publications/kt4ttupdate2_10.pdf)). Also, view the archived webcast *Begin with Knowledge Translation; Have the End—Technology Transfer—in Mind* (<http://www.ncddr.org/webcasts/webcast27.html>).

For more detailed information on the subject of knowledge translation for technology transfer, we invite you to examine the Need to Knowledge (NtK) model, a new product development model for technology-based commercial devices and services, at the KT4TT Web site (<http://kt4tt.buffalo.edu/knowledgebase/model.php>).

For more information on the Picture Communication Symbols, shown on page 5, contact:  
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 Web site: [www.mayer-johnson.com](http://www.mayer-johnson.com)

## Product Utilization Support and Help (PUSH) Award

The Product Utilization Support and Help (PUSH) Award is a peer-to-peer dissemination activity. It recognizes NIDRR technology grantees, such as RERCs and SBIRs, who are using “best practice” approaches to development, transfer, and/or production processes. The goal of the award is to provide the broader NIDRR community with exemplars of research utilization that have proved to be effective.

PUSH candidates are technology grantees identified by KT4TT staff as conducting meritorious activity in technology transfer or knowledge translation for technology transfer. Upon identifying a candidate, the KT4TT staff, in conjunction with the selected grantee, generates a short evidence-based description of a carrier used to successfully overcome a barrier within the technology transfer process. The supporting evidence may include research and/or practice knowledge.

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## CENTER ON KT4TT

The 5-year **Center on Knowledge Translation for Technology Transfer (KT4TT)** project (<http://kt4tt.buffalo.edu>) was awarded to the University at Buffalo (SUNY), Center for Assistive Technology (CAT) on October 1, 2008. SEDL and Western New York Independent Living, Inc., are partners in the project. SEDL's role focuses on utilization-oriented methods of dissemination, training, and technical assistance to effectively communicate with knowledge producers and knowledge users. This *FOCUS Technical Brief* is a product of the SEDL-KT4TT partnership.

The project focuses on three key outcomes:

- *Improved understanding* of the barriers preventing successful knowledge translation for technology transfer and ways to overcome these barriers
- *Advanced knowledge* of best models, methods, and measures of knowledge translation and technology transfer for achieving outcomes
- *Increased utilization* of these validated best practices by NIDRR's technology-oriented grantees



Center on Knowledge Translation for Technology Transfer

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Advancing Research, Improving Education



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NCDDR's scope of work focuses on developing systems for applying rigorous standards of evidence in describing, assessing, and disseminating outcomes from research and development sponsored by NIDRR. The NCDDR promotes movement of disability research results into evidence-based instruments such as systematic reviews as well as consumer-oriented information systems and applications.

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