

Upfront



Medicine, rehabilitation, education and social services are meant to impact people's lives and society in positive ways. Speech-language pathology, rehabilitation medicine, early childhood and special education, occupational therapy and other disciplines play key roles in the lives of people with complex communication needs (CCN). Areas of practice, such as augmentative and alternative communication (AAC), have a research base, clinical practice guidelines and assistive technologies to help ensure that people with CCN have access to high-quality treatment delivered by trained professionals.

Government agencies often set policy and help fund health-care and education-related services, as well as research, development and training projects aimed at improving services and technologies. The National Institute on Disability and Rehabilitation Research (NIDRR) in Washington, D.C., funds 25 Rehabilitation Engineering Research Centers (RERCs). Their mandate is to solve rehabilitation problems and remove environmental barriers for persons with disabilities.¹ Each RERC has a specific focus, *e.g.*, mobility, hearing, vision, communication, workplace accommodations, wireless technologies, technology transfer. All emphasize the development and utilization of assistive and mainstream technologies in solving problems faced by persons with

disabilities. Many millions of dollars are awarded to RERCs each year, and the outcomes and impacts of NIDRR-funded projects need to extend beyond lining the coffers of participating research institutions, academic departments, faculty/staff salaries and student stipends. Successful RERC outcomes require that the knowledge gained through research and development (R&D) projects improves the lives of people with disabilities and fosters their participation in society.¹

In this issue, we consider the potential impact of R&D activities funded through the RERC on

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AAC research and development: Having an impact

Bridging the gap between research and practice is not easy. In fact, traditional methods of dissemination are not particularly effective knowledge transfer activities, as they do not typically impact clinical practice or change behavior.² Likewise, transferring emerging technologies or technology features from research laboratories to products or product features in the commercial market is never easy.

Traditionally, the dissemination of research results has, more or less, meant a unidirectional flow

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of knowledge—from researchers to certain other stakeholders. Not surprisingly, the knowledge uptake by practitioners and manufacturers has often been limited.

Researchers, developers, service providers and end users inhabit different worlds, with different languages and cultures.^{3,4} Traditional dissemination mechanisms like journal articles, book chapters, trade shows and conference presentations may be helpful venues for sharing knowledge with those who read the professional literature and/or attend conferences, but they do not generally result in changes in behavior or practice. The mere reception of research results by a potential user does not imply their use.⁵

Similarly, the successful transfer

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of design features and prototypes to new technologies, products and materials is often fraught with difficulty. Issues of intellectual property (e.g., patents, revenue sharing, non-disclosure agreements and licensing), industry competition and other barriers can obstruct the transfer of new technologies, products and/or product features to the marketplace.

Knowledge translation

Over the past few years, there has been a seismic shift in how the National Institute on Disability and Rehabilitation Research (NIDRR) has approached the gap between research and practice. Because NIDRR expects to see its investment in research and development (R&D) activities yield maximum benefits for individuals with disabilities, it has adopted a *knowledge translation* approach toward shaping new technologies, improving service delivery and expanding decision-making op-

tions for people with disabilities.⁶

Knowledge translation (KT) is a relatively new term, and one that is meant to represent all steps taken between the creation of new knowledge and the beneficial application of that knowledge in society.^{7,8} The Canadian Institutes for Health Research (CIHR), which coined the term, defines KT:

The exchange, synthesis, and ethically-sound application of knowledge—with in a complex set of interactions among researchers and users—to accelerate the capture of the benefits of research for Canadians through improved health, more effective services and products, and a strengthened health care system.⁹

There are many iterations of CIHR's definition, mostly within the medical and health-care literature. NIDRR similarly defines KT:

The multidimensional, active process of ensuring that new knowledge gained through the course of research ultimately improves the lives of people with disabilities and furthers their participation in society.¹⁰

KT is an umbrella term, encompassing other familiar terms and referring to a range of activities and processes designed to ensure the utilization of research-based knowledge. According to Pimjai Sudsawad, the KT Program Coordinator at NIDRR, it includes knowledge transfer, dissemination, technology transfer, knowledge management and utilization, two-way exchanges between researchers and those who apply knowledge, implementation research, technology assessment/synthesis within the global context and development of consensus guidelines.⁸ KT activities are designed to ensure utilization of new knowledge and technologies that arise from research and bridge gaps between research and practice in ways that (1) enhance the lives of individuals with disabilities, (2) inform disability and rehabilitation policy and (3) improve practice.⁷ Obviously, KT also intersects with a focus on evidence-based practice (EBP), whereby practitioners are encouraged to make practice decisions by integrating peer-reviewed research results and meta-analysis reviews with their clinical expertise and the client's unique values and circumstances.¹¹

Identifying barriers

On one hand, we have the buzzing activities underway in our AAC research institutions and AAC industry and, on the other, the daily experiences of practitioners and people with complex communication needs (CCN). The connections between them are at best loose ones. The result of this particular disconnect is sometimes referred to as the *underutilization* of research in daily practice, and described as a gap between “what

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Communication Enhancement, known as the AAC-RERC.* We cite examples of how, over the past nine years, the knowledge gleaned from AAC-RERC projects has, among other things, influenced the design of speech generating devices (SGDs) and, in so doing, the lives of people with CCN. **University & Research** introduces the area of knowledge translation (KT) with its myriad of activities and processes. **Case Examples** briefly illustrate three AAC-RERC projects. These projects showcase how a KT approach can lead to successful technology and knowledge

* The AAC-RERC consists of seven research institutions (Duke University, Penn State University, Temple University, the University of Buffalo-New York, the University of Nebraska, Children's Hospital-Boston and Augmentative Communication, Inc.). Its ten partners direct research, development, training and dissemination projects.

transfer activities by involving key stakeholders and extending dissemination well beyond traditional mechanisms, to ensure that research results ultimately become available to individuals who rely on AAC and those who support them. The challenges are many. Among them are converting results into products and instructional strategies, and engaging important stakeholders within and outside the AAC community in using new products and strategies.

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is known” and “what is currently done.”¹² In short, when the research results, prototypes and device features from R&D projects remain inaccessible to the people they are designed to help, then KT does not occur.

The fact is that AAC researchers, developers, policymakers, manufacturers, practitioners and people with disabilities reside in different worlds with lives and daily realities that are poles apart:

- Researchers typically function in academic institutions where traditional rewards are given for publications in peer-reviewed journals, presentations at conferences, research grant awards and excellence in teaching.
- Practitioners function locally and adapt their practices to the standards and needs of the community. Licensed practitioners are often rewarded for productivity and efficiency (e.g., billable hours). A relatively small percentage routinely read professional journals or travel to conferences where AAC researchers present results and manufacturers display AAC equipment and materials.
- Persons with CCN and their family members are a widely diverse group. Many struggle financially, and few enjoy the same economic, educational, health-care or social advantages that AAC practitioners, researchers, manufacturers and policymakers experience. While some are interested in AAC research results, most just want access to the AAC tools and strategies that work best for them so they can communicate what, when and how they want.
- The bottom line drives the AAC industry. To stay in business, vendors must make a profit. Manufacturers remain vigilant about new technologies in the commercial market and what their competitors are doing. They often rely on employees (development, marketing, technical support departments) and a cadre of AAC practitioners and consumers as consultants when planning or designing products. On occasion, manufacturers adopt (and adapt) ideas, design features and prototypes from outside researchers.

In the face of these different realities, mindful connections must

be carefully fostered. Taking a KT approach requires that researchers and developers include from the *get-go* people with disabilities, practitioners, family members and industry representatives (as appropriate) to define problems that lead to R&D projects that will result in useful solutions. The ultimate success of R&D projects in the RERC network, for example, is measured by the degree to which results are used and valued by targeted groups.

Technology transfer

Within NIDRR, technology transfer is an especially vital component of KT. Technology transfer (TT) is defined as the process of converting scientific findings from research laboratories into useful products in the commercial sector. TT involves a wide-range of activities and processes, such as 1) conceiving of new applications for an existing technology, 2) converting research into technical and economic development, 3) licensing intellectual property to manufacturers for use in their products, 4) realizing ideas in prototypes and 5) recording technological concepts in professional papers or patent applications.¹³ While TT may involve legal contracts and formal agreements, it can also occur quite informally.

The goal of TT is to increase the quantity of R&D results that end up in commercial products. The AAC-RERC is committed to successful TT and has implemented a Tech Transfer Plan with a philosophy and mechanisms to meet tech transfer goals.¹³ R&D projects are monitored and periodically reviewed by the AAC-RERC tech transfer team.

Research to practice

Many top AAC researchers are also master clinicians (and *vice versa*). Some developers work

for AAC companies, as do some individuals who rely on AAC. Thus, in the field of AAC, there is often a natural (albeit far from consistent or well organized) exchange of information among stakeholder groups. AAC researchers, for example, have provided key evidence and dispelled myths about AAC practice:

- AAC does NOT hinder a person’s development or return of speech. In many cases intelligible speech actually improves after AAC is introduced.¹⁴
- There are no prerequisites for communication and, thus, for AAC interventions. People who are unable to communicate effectively do not need to be a certain age or have a particular linguistic/cognitive level to benefit from AAC strategies, techniques and technologies. Communication begins at birth and continues throughout life. While certain devices, techniques and strategies require specific skills and abilities, AAC interventions can help support communication efforts across all skill levels.¹⁵
- AAC does NOT signal that professionals are “giving up” on speech. AAC is recognized as a mainstream area of practice. AAC helps children and adults compensate for severe communication challenges.^{16, 17}

Increasingly, AAC research reviews are available, and there are now journals dedicated to this purpose.^{18,19} Aspects of the evidence base are reviewed by Diane Millar, Janice Light and Ralf Schlosser,¹⁴ by Mary Ann Ronski and Rose Sevcik²⁰ and by Ralf Schlosser and Pammi Raghavendra,²¹ making it somewhat easier for clinicians and family members to access the information. Krista Wilkinson and Sharon Hennig reviewed the research on AAC with children who have developmental and intellectual disabilities, highlighting the importance of multimodal communication, the need to consider both comprehension and production, the potential impact of aided language

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stimulation and augmented input on language development and learning issues around different types of representational systems.²² Others have summarized information about the importance of communication partners in AAC interventions.²³ Finally, the book, *Augmentative Communication Strategies for Adults with Acute and Chronic Medical Conditions*, reviews existing evidence and suggests clinical strategies based on that evidence.²⁴

Even with a growing knowledge base in AAC, clinicians, teachers and family members lack guidance when making decisions about which AAC strategies/technologies to use and why. It is unrealistic (and unfair) to expect practitioners to implement new practices from research reports or review articles, or after attending a presentation or workshop. Unless, and until, the results of evidence-based R&D efforts are packaged in ways that make them readily available to clinicians, teachers, family members (including those with very little experience in

AAC), even the most convincing research results are unlikely to change practice.

Enter KT. With a KT approach, researchers understand that publishable results and device prototypes are crucial first steps. Real success depends on the extent to which results are available for use in new or existing products.

Logic modeling

Logic modeling is a helpful KT planning, as well as evaluation, tool.²⁵ A logic model links the problem (situation) to the intervention (inputs and outputs). It helps identify goals, clarify targeted beneficiaries and forge partnerships. Making logical, dynamic linkages among resources, activities, outputs and audiences raises the likelihood that short- to long-term outcomes are successful.

Figure 1 illustrates a basic logic model for AAC-RERC projects.²⁶ Partners consult with key stakeholder groups to identify a problem/situation and specify who can benefit if it is solved.

Steps to prioritize goals and garner and leverage human, institutional and contractual resources are taken so that project activities and outputs are accomplished as efficiently and effectively as possible. Tech transfer mechanisms and strategies are explored. The logic modeling process is iterative, in that ongoing evaluation and mid-course corrections are made along the way. It constantly refocuses attention on outcomes and impacts that can affect the daily lives of practitioners, people with disabilities and social, education and health-care policy.

Summary


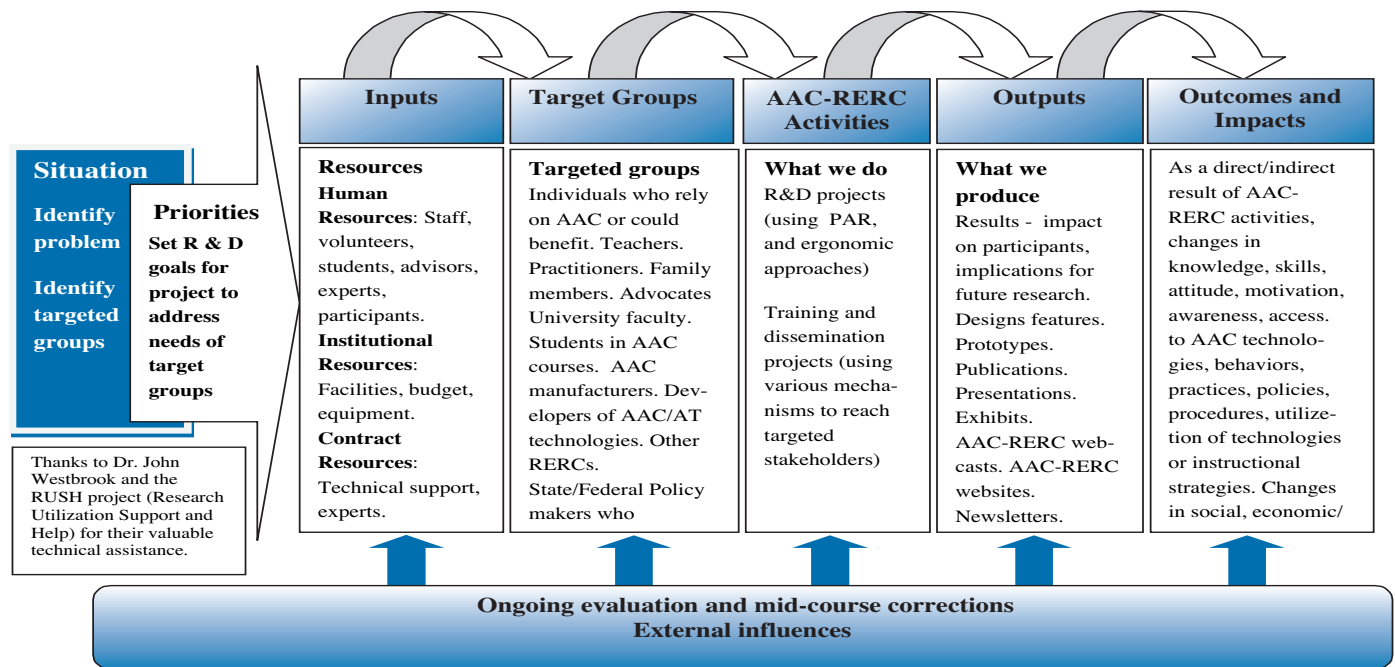
In the past, a disproportionate amount of total research dollars was spent on R&D, with relatively little attention paid to funding or planning for KT. Today, AAC-RERC researchers collaborate with a variety of stakeholders to increase the likelihood that KT occurs. The following articles provide case examples that illustrate the use of logic modeling and successful KT. 

Figure 1. AAC-RERC Logic Model: An Overview



Case Example #1



AAC technologies for beginning communicators

Young children with cerebral palsy, autism, Down syndrome, developmental delay, traumatic brain injury, apraxia, dysarthria, severe cognitive challenges, *etc.*, who are at risk for not developing speech need access to appropriate AAC strategies and technologies. Children are not little adults. They have different learning styles, needs and preferences, and they require AAC technologies and strategies designed specifically for them. For example, they need AAC technologies that are easy to learn and use and that support the development of language, communication and literacy skills.

The situation: In 1998, Janice Light, Kathryn Drager and their colleagues at Pennsylvania State University took notice: Clinicians and parents were reporting that synthesized speech generating devices (SGDs) were too difficult for young children to use and unappealing to them. Light and Drager, along with their research team, mapped out a multi-staged research agenda designed to increase the learnability,

usability and appeal of AAC technologies for beginning communicators.

Using a logic model, we can describe the research process as follows:

Research priorities:

- (1) Identify and document substantive access barriers to AAC technologies for young children without disabilities (ages 2 1/2 to 6 years).
- (2) Identify and document strategies and technology features that (a) young children find appealing, (b) enhance learning of AAC technologies and strategies and (c) enhance effective use of AAC technologies and strategies.
- (3) Demonstrate the effectiveness of new AAC technologies/features and instructional strategies over time with young children with disabilities who rely on AAC.
- (4) Transfer knowledge and technology features to the AAC industry and to AAC practitioners, family members and policymakers using a variety of knowledge translation (KT) strategies to ensure that beginning communicators and those who support them can benefit from the research.

Inputs: Light and Drager brought extensive human and institutional resources to this AAC-RERC funded project. Thousands of hours of student, staff and faculty time and many outside resources were invested. The participatory action research (PAR) design involved family members, industry representatives and advisory board members.

Research activities and outputs: Initially, the project focused on children without disabilities, ages 2 1/2 to 7 years. Researchers conducted a series of studies designed to identify access barriers to current AAC technologies.

Note: researchers used dynamic display devices, rather than phrase-based digitized devices, because they provide access to large vocabularies and allow children to generate language.

Results clearly demonstrated that the linguistic and organizational demands of AAC interface strategies exceeded the capability of most typical children and lacked sufficiently appealing features.

1. Young children really struggled with grid layouts (especially when Minspeak was used). Vocabulary represented by separate AAC symbols in “boxes” took language out of context. In addition, results confirmed that organizational strategies based on taxonomic and schematic grid layouts were difficult for children without disabilities to navigate.^{27,28,29}

2. Visual scene displays (VSDs) with vocabulary embedded in ‘hot spots’ were easier for young children to learn and use. Schematic scenes preserved visual and conceptual contexts. With scaffolding, very young children were able to navigate using VSD pages.^{27,28,29}

3. Many AAC devices lack appealing characteristics common in commercial electronic games and toys that attract and sustain a child’s interest.^{30,31}

To summarize, traditional displays imposed unacceptable cognitive/linguistic demands on young children. Results with typical children were published in peer-reviewed journals, other media and presented at conferences. Recommended design features were widely shared with AAC manufacturers.

Their results also formed the basis for a longitudinal, multiple-baseline study of young children with developmental disabilities. Light and Drager designed this study to evaluate the effectiveness of using

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Table I. AAC technologies for young children with CCN: Some desirable features

1. SGDs that are colorful and playful, easy for infants to understand and use. SGDs that are easily embedded in play and other everyday interactions.	5. Flexible features, easy to modify. Allow for seamless developmental transitions, quantitatively and qualitatively.
2. Easy instructions for partners so they can learn how to interact effectively with beginning communicators.	6. SGDs that can be integrated across multiple functions (e.g., communication, play, social interaction, entertainment).
3. Reduced learning demands through utilization of developmentally appropriate representations, organizations, layout, navigation, selection and output.	7. Dynamic, easy. Just-in-time programming so young children can access the language they need to communicate in the moment it occurs.
4. SGDs that can support visual scene display (VSD) options and provide children with access to large, dynamic vocabularies.	8. Dynamic interactive contexts that support children and partners during communication.

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redesigned AAC technologies, along with research-based instructional strategies with the children. Data is being collected over time on each child's communication behaviors, language and literacy skills.

To date, nine children with significant communication disabilities are participating. At baseline, these children were between six months and four years old. All were non-symbolic or minimally symbolic communicators. Some children have participated for more than three years; others for just a few months. During a weekly therapy session, researchers introduced low- and high-tech AAC technologies to each child and family members in their home. Children used VSDs during their first session and found them to be motivating interfaces. All now use hybrid and/or grid displays and can navigate to appropriate pages on their high-tech devices. Some still benefit from adult scaffolding, while others are independent. All participants have


- significantly increased their rates of turntaking and periods of sustained interactions;
- increased their participation in interactions that involve social routines and play activities;
- used their AAC systems independently for play and learning, and as a context to interact with peers, share books and sing;
- demonstrated significant increases in expressive vocabulary—some children acquiring as many as 5 new words/day;
- have acquired a range of semantic concepts and are combining concepts to communicate complex meanings.³²

Table II gives examples of project outputs, outcomes and impacts. The R&D team employed a variety of traditional and state-of-the-art dissemination mechanisms and TT strategies. KT has begun to occur. For example, AAC devices on the market today are more colorful, and many offer VSD options. Also,

Table II. Beginning communicators: Examples of KT activities

Outputs	Outcomes	Impacts
Presentations (ASHA, SOSOC, ISAAC, PSHA) Invited presentations (AAAS)	Story on NBC TV Newspaper articles	Requests from family members, hospitals, doctors for services
Peer reviewed publications (<i>AAC, Perspectives</i>). Other publications (newsletter, chapters)	Other agency website postings, citations by others	References to work from outside the field
Design specs to manufacturers (see Table I). Prototypes developed and used.	VSDs in new AAC technologies. More systems offer colors and other options	AAC technologies with VSD and appeal features being recommended/purchased/used
AAC-RERC webcast	AAC-RERC webcast viewed by 949 people	AAC-RERC webcast offered for ASHA CEUs

AAC-RERC webcasts and presentations are bringing significantly more people to the results. Finally, having mainstream media attention increases awareness of what's possible.

Website coming! Researchers are far from done. They are working on an instructional website for parents, teachers and practitioners. The site will provide "how to" information and case examples. Researchers will continue to refine their design specifications and instructional strategies while maintaining dialogues with AAC manufacturers and practitioners. 

Go to www.aac-rerc.com for a list of journal articles, links to the AAC-RERC webcast and slides from the 2007 ASHA presentation.

Case Example #2

AAC technologies for adults with aphasia & traumatic brain injury

Adults with severe chronic aphasia and traumatic brain injury who experience difficulty speaking may use high- and low-tech AAC technologies to support their communication efforts. However, given the nature of the cognitive and linguistic disabilities they confront, these individuals often can benefit from low-tech communication books or simple AAC technologies even though they

are often tied to therapy or practice sessions and used in specific or limited situations, e.g., express basic needs, make/receive phone calls, order in a restaurant.

Given the extensive life experiences, family roles and social networks of these adults, there is an unmet need for AAC technologies that are easy to learn and use and that support meaningful communication exchanges about a variety of topics with preferred partners.

The situation: In 1998, David Beukelman and his colleagues at the University of Nebraska and the Madonna Rehabilitation Center began to explore the use of visual scene displays as an AAC interface

to speech generating devices (SGDs) for adults with severe aphasia. They had noted that contextually-rich photographs depicting familiar people, places and events, i.e., visual scene displays (VSDs) can help establish contexts for conversations. They hypothesized that AAC technologies with VSD interfaces could be useful for adults with cognitive-linguistic challenges.

Research priorities:

- (1) Develop a prototype AAC device that uses a VSD interface.
- (2) Evaluate the effectiveness of the prototype interface to determine if it enhances the communication of adults with severe acquired language

Table III. Visual scene display for people with aphasia and TBI: Examples of KT activities

Outputs	Outcomes	Impacts
Presentations (ASHA, SOSC on AAC, ISAAC, SOSC on Cognitive Disabilities, <i>etc.</i>)	Commercial partnership with Dynavox	VSD for adults with TBI & aphasia included in every Dynavox V or Vmax sold
Peer reviewed publications in journals, chapters, newsletters	Other agency website postings, citations by others	Ongoing research on utilization of VSDs with specific groups
Prototype developed, tested, design spec shared	Tech transfer to DynaVox Technologies: Dynavox V/ Vmax	After 1 year, 28,726 downloads of low-tech VSD Templates for people with aphasia and TBI
Low-tech versions of VSD for people with aphasia/TBI posted on UNL website	Second set of templates posted for people with developmental disabilities	After 3 months, downloads of low-tech VSD Templates for people with DD
AAC-RERC webcast	AAC-RERC webcast viewed by 902 people	AAC-RERC webcast offered for ASHA CEUs

disorders (*e.g.*, aphasia and traumatic brain injury).

(3) Transfer knowledge and technology features to the AAC industry and to AAC practitioners, family members and policy makers using a variety of knowledge translation (KT) strategies.

(4) Work with industry partners and practitioners to ensure utilization of AAC technologies by adults with cognitive-linguistic challenges (aphasia and TBI) and their communication partners.


Inputs: Beukeleman and his colleagues in Nebraska have leveraged key human, institutional and consultative expertise in carrying out this AAC-RERC funded R&D project.

Activities and outputs: Researchers developed design specifications for VSDs. They need to:

(1) represent meaning, (2) support navigation in an AAC system, (3) serve as a platform for co-constructing messages with listeners and a shared communication space and (4) enable individuals to use other types of communication supports simultaneously, if they wish.

Low-tech versions for people with aphasia, TBI and adults with developmental disabilities are now available (without cost) at the UNL website aaa.unl.edu. Researchers have established a commercial partnership with Dynavox Technologies to further develop and distribute a high-tech version of the VSD interface along with instructional supports. Other outputs are published

case reports, small studies of clinical interventions and experimental studies on preference, message representation and navigation of interface.³³⁻³⁵

Table III features current outputs, outcomes and impacts of the project. The VSD interface is being refined based on usability evaluations. There is also evidence of broad uptake from within (and perhaps outside) the AAC community through the downloads of low-tech VSDs from the website. Additional studies about utilization with individuals and groups are underway. A major challenge is to engage practitioners who specialize in aphasia and traumatic brain injury. 

Go to www.aac-rerc.com for a list of journal articles, a link to the AAC-RERC webcast and slides from 2007 ASHA presentations.

Case Example #3

Literacy and AAC

Teaching literacy skills is the single most empowering thing that we can do for individuals who require AAC. (Lindsay, 1990).³⁶

The situation: There has been a long-standing need to provide teachers, parents, aides, speech-language pathologists, *etc.* with easy-to-access, appropriate, evidence-based

literacy instruction they can use with individuals who have CCN.

Priorities: An AAC-RERC research team, led by Janice Light and David McNaughton, sought to develop evidence-based literacy instruction for individuals who rely on AAC and to make these materials readily available to key stakeholders.

Inputs: Researchers brought extensive human, institutional and consultative resources to the project.


Activities and outputs: Based on the National Reading Panel (2000) guidelines, researchers developed, implemented and evaluated instructional literacy content they had adapted for people who rely on AAC. They used a multiple baseline design with eight participants (ages 3 to 50 years) who rely on AAC to conduct field tests of their materials. Participants included those with autism, cerebral palsy, developmental apraxia and Down syndrome.

Outcomes/Impacts: All participants successfully acquired targeted literacy skills. Some made very rapid progress; others required more time to learn. All participants, families and schools reported high levels of satisfaction with outcomes.

KT activities have included peer-reviewed publications^{37,38} and presentations using different formats

to reach targeted groups (*e.g.*, 1060 have viewed the literacy webcast).

Very importantly, successful TT has occurred. Mayer Johnson

Company is publishing a hard copy version and Dynavox Technologies will be distributing a high-tech software version for the Dynavox V and Speaking Dynamically Pro. 

Go to www.aac-rerc.com for a list of journal articles, links to the AAC-RERC webcast and a 2007 ASHA presentation.

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