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Upfront

The virtual AAC-RERC

All of us in the augmentative communication community are impatient for the next technical breakthroughs—the next generational leaps in the ways AAC technologies are designed and manufactured. That is why the federally funded Rehabilitation Engineering Research Center on Communication Enhancement (the AAC-RERC) is so important to people with communication impairments and to those who work and live alongside them. How well this center functions in the real world can potentially make a big difference over the next decade.

The AAC-RERC is unique among the network of 15 RERCs funded by the National Institute on Disability and Rehabilitation Research (NIDRR) by virtue of the fact that it is a "virtual" center, consisting of AAC researchers from seven far-flung institutions who cooperate and collaborate across extensive distances and time zones. This novel setup raises a number of interesting questions. What happens when AAC researchers collaborate virtually? Does a synergy grow from their research, engineering, training and dissemination activities? Can a virtual team work over distance and time to address key research and engineering questions? Will their work make a difference in how AAC technologies are designed and manufactured? Can the whole be greater than its parts? Can this collaboration make a positive and lasting difference in the lives of individuals with severe communication impairments? The answers to these questions are beginning to unfold.

A primary emphasis of the AAC-RERC is the cognitive-linguistic interface issues between individuals with severe communication disorders and AAC technologies. Another focus is the human factors affecting the interaction process from the viewpoints of augmented communicators and their communication partners. In addition, AAC-RERC researchers are looking at the use of AAC technolo-

Continued on page 2

On the Web

www.aac-rerc.com

The AAC-RERC website is a Duke University project that captures the collaborative efforts of the partners and serves as a major information dissemination mechanism for the virtual center. As such, it is a useful place to visit on a regular basis.

The AAC-RERC mission

The mission statement reads:

To assist the users of AAC technologies in achieving their goals by advancing and promoting AAC technologies and supporting the individuals that use, manufacture, and recommend them.

inside this issue

R & D projects

These web pages have up-to-date information about each partner's research and development projects, as well as ongoing training and dissemination activities.

AAC events and AAC links

These web pages help visitors contact AAC-RERC partners, AAC and assistive technology (AT) manufacturers, organizations, publishers and others in the RERC network. There are also links to sites with information about government and regulatory policies, Internet and web accessibility and people who use assistive technologies.

Continued on page 2

On the Web, Continued from page 1

Medicare funding of AAC devices

The AAC-RERC provides technical assistance to the field to support the implementation of the new Medicare policy on AAC devices (which Medicare calls SGDs or speech generating devices). These web pages are the result of work by a group of volunteers, the Medicare Implementation Team (MIT), who develop training materials for dissemination.[1] This information is in response to the January 2001 reversal of Medicare's long-standing policy that considered AAC devices "convenience items."

Because Medicare is the world's largest health insurance program and a leader in health insurance policy, their decision to fund AAC devices has implications not only for millions of Medicare beneficiaries (mostly people over the age of 65 years), but also for other health insurance programs in the United States and other countries.

Contact Sarah Blackstone or Kevin Caves

The CRADA

The Naval Air Warfare Center Training Systems Division (NAWCTSD) and the AAC-RERC have announced a coordinated program to monitor and explore technology developments that could potentially have an impact on the engineering aspects of AAC technologies. The resulting CRADA (Cooperative Research and Development Agreement) was signed in January 2000. See photo on page 3.

The alliance currently is working on a *proof of concept* project to develop a prototype, computer-based movement recognizer that any person, including persons with severe communication disorders, could use. The goal is to make a "recognizer" that can interpret discrete movements as commands and then do whatever the device is programmed to do—turn on a light, speak a phrase, open a door and so on. If successful, the prototype could be the precursor to using movement as a way to control an AAC device or computer.

Contact Frank DeRuyter or Kevin Caves

Technology white papers

From time to time, AAC-RERC partners develop technology white papers and post them to the website to share information about specific technology applications.

1. Head contact microphone. This white paper describes a Duke "TechWatch" project collaboration with the Federal Labs Consortium (FLC) that has led to the discovery of a skin-contact microphone. The mike was developed originally by the Navy Seals and was later adapted for use by firefighters. It enables individuals who have difficulty using standard head or throat mounted microphones to amplify their voices, control a speech recognition system and more. The mike can be placed anywhere on the head and is moisture proof.

Contact Kevin Caves or Frank DeRuyter

2. Virtual research strategies

Virtual research strategies are enabling AAC-RERC partners to collect data and accomplish other research and training tasks across broad geographic areas. Five strategies are summarized below.

Strategy 1. To collect data on the expert opinions of AAC intervention

Upfront, Continued from page 1

gies in specific contexts (work and school).

The AAC-RERC partners are listed on pages 4 and 16 and are located at the following institutions:

Augmentative Communication, Inc., Duke University, Pennsylvania State University, Temple University, University at Buffalo-SUNY, University of Nebraska-Lincoln and University of North Carolina-Chapel Hill.

This issue of ACN summarizes the progress being made within the AAC-RERC. The first article, *On the Web,* highlights information available to the AAC community at www.aac-rerc.com. The other sections describe important research and development activities under way at participating universities.

A key feature of the AAC-RERC is the partners' collective insistence that people who use AAC technologies participate in the work that is being done. The virtual nature of the center makes it easier to establish meaningful contact with augmented communicators and enables members of the AAC community to work alongside university researchers.

AAC-RERC partners also have a strong commitment to mentor the next generation of clinicians, educators, researchers and engineers who plan to work in the area of AAC.

When a cadre of productive AAC researchers collaborates in this manner, the results may indeed influence future AAC technology design and clinical practice. It behooves us to stay informed and to mark their progress.

Sarah W. Blackstone, Ph.D., Author

CRADA signing at NAWC/TSD, Orlando, FL

specialists from a geographically diverse area when anonymity is not required.

Virtual tools: Conventional computers, conventional email applications

Researchers used email strategies to collect data from AAC specialists. Data collection took only ten days and the response rate was excellent (92% following a first request and 98% after the second request).
Contact David Beukelman

Strategy 2. To solicit opinions from AAC specialists, people with ALS and their spouses/caregivers when anonymity is required.

Virtual tools: Microsoft Frontpage Server Extension; conventional computer; Netserver Software; Virtual Network Computing (VNC)

Researchers used a specialized World Wide Web site to get feedback about a prototype version of an AAC interface. Subjects were able to "see" the interface on the site and respond to questions about its design. In addition, individual AAC users were able to work at their convenience, using their own computers and AAC technology. Because all responses were collected in electronic format, additional data entry is unnecessary and confidentially can be assured.
Contact David Beukelman or Kevin Caves

Strategy 3. To use remote computer-control technologies to work collaboratively across computer platforms (Macintosh, Windows, UNIX, NT).

Virtual Tools: Conventional computers, Internet connections, Virtual Network Computing (VNC).

Researchers are utilizing up to four "viewer" computers using VNC to: (a) involve experts at remote sites in the development of software; (b) enable AAC-RERC staff to support consultants, augmented communicators and others at remote sites; (c) allow people at remote sites to learn how to use net conferencing software; and (d) support discussions during research meetings by placing PowerPoint presentations on a temporary website so participants can see data while conferencing by phone.
Contact David Beukelman or Kevin Caves

Strategy 4. To support voice (and picture) communication as well as reduce long distance phone charges.

Virtual Tools: Netmeeting; Netmeeting Primer; camera; headset (Andrea Electronics); FireTalk and BATDesktop Telephone

Researchers report on *Point-to-Point vs. Multipoint, NetMeeting and FireTalk* products and discuss how the number of participants involved in virtual conferencing influences the selection of technology and software.
Contact David Beukelman or Kevin Caves

Strategy 5. To manage the recording, refining, transferring, and storing of audio samples across clinical settings.

Virtual Tools: Apple Macintosh computer technology; headset (Andrea Electronics); Griffin iBook (Griffin Technology); CD Writer (Sony Spressa)

Using computer technology to manage audio speech samples enables researchers to electronically transfer data to a central laboratory for analysis and transcription and then to transfer the analyzed data back to the clinical sites.
Contact David Beukelman

Communication performance assessment (CPA)

These web pages focus on the assessment of AAC device use and include information about:

- Techniques and software to facilitate performance assessment of technology and device use.
- Theoretical underpinnings of device design and user performance.
- Information on automated data logging.
- Bibliography of CPA related articles and links to research and practice in other areas.
- Discussions on related topics, including consideration of privacy issues.

Contact Jeff Higginbotham

AAC-RERC State of the Science Conference

The AAC-RERC hosts a State of the Science Conference in August 2001 that brings participants together for three days of discussions and planning for future technology research and development in the area of AAC. The conference is being held in conjunction with the 2001 USSAAC conference in St. Paul, Minnesota. Outcomes will include a report to NIDRR and a publication by Paul Brookes Publishing, which

Continued on page 4

On the Web, Continued from page 3

will reflect the current state of the science and highlight future directions for AAC technology development.
Contact Kevin Caves

Demand-pull project

These web pages describe the ongoing collaborative effort between the Rehabilitation Engineering Research Center on Technology Transfer (T2RERC) and the AAC-RERC. The purpose of the Demand-Pull project is to identify crucial, unmet technology needs in the area of AAC technologies and to foster activities within and outside the AAC industry to better meet these needs.[2]

Duke Projects

The five-year AAC-RERC grant was awarded to Duke University in 1998. Frank DeRuyter is the principal investigator and Kevin Caves is the Director of the AAC-RERC. In addition to their administrative responsibilities, they conduct projects and collaborate with other partners. DeRuyter and Caves serve with Beukelman and Blackstone on the AAC-RERC management team. Caves manages the website.

Tech-watch project

Kevin Caves, Frank DeRuyter, Duke University; Howard Shane, Children's Hospital, Boston

The Tech-watch project has vigorously pursued the NIDRR directive to explore research and development activities within the Federal Laboratories Consortium (FLC) as a way to locate, develop and transfer appropriate leading edge technologies to the AAC field. Project staff monitor and actively seek out technological developments in commercial form and pre-release development stages that can impact the engineering (and indirectly the clinical) aspects of the AAC field.

Tech-watch staff have monthly conference call meetings with FLC representatives and have made presentations at various regional FLC Consortium meetings.

Results and discussion. Tech-Watch results include the identification and testing of a skin-contact microphone as described on page 2. Staff are encouraging the manufacturer to modify the mike in ways that make it useful to individuals with severe communication impairments. In addition, the Tech-watch project has: (a) shared info with the Telecommunications RERC regarding cell phone use by users of AAC technology; (b) shared information with the Sensory Aids RERC regarding wayfinding technologies; (c) collaborated with the Demand-pull project with T2RERC staff as described above and (d) established the first NIDRR Cooperative Research and Development Agreement (CRADA) with an RERC as described on page 2.

Future directions

In collaboration with the FLC, Kevin Caves is directing a new research and development project in the use of Automatic Speech Recognition (ASR) as an AAC interface for individuals with moderate-to-severe speech impairments.

AAC-RERC partners

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Continued on page 16

Penn State

Penn State Projects

Pennsylvania State University has two AAC-RERC partners. David McNaughton is directing a project related to AAC employment issues and coordinating Tech 2010, an AAC consumer project. Janice Light is directing a project that addresses the design features of AAC technologies for young children.

Information on these projects is available at http://aac.hhdev.psu.edu

The employment project

David McNaughton, Janice Light, Linda Groszyk, Kara Birmingham, Arielle Parsons & Stephanie Gulla

The employment project has two phases. Phase I involved a retrospective analysis of employment experiences for individuals who use AAC. Phase II is a prospective analysis of the supports required and barriers that exist to employment for augmented communicators.

Phase I. In progress.

Methods. Researchers are investigating key barriers to employment, as well as strategies for overcoming these barriers with four groups of individuals: (1) individuals who require AAC and are successfully employed, (2) employers, (3) family members and (4) employment support professionals. To date, researchers have held focus groups with five individuals who have ALS, 23 individuals with cerebral palsy and a growing number of individuals with autism. In addition, researchers have interviewed by telephone and email 14 employers and co-workers and eight family members.

Results and discussion. The project is providing a sense of what is required to make employment for augmented communicators "work" in the real world and the nature of the substantial barriers they face. Preliminary results are summarized in Table 1. Among augmented communicators with jobs, employment obviously plays a major role in their daily lives. Project results illuminate what a complex struggle it is to obtain the support necessary (both within and outside the workplace) to remain employed. There is thus a crucial need to help AAC users find good person-to-job matches in the first instance, and then help them develop the myriad skills necessary for continuing workforce participation. Employers also need support in making informed decisions about hiring and maintaining AAC users on the job. Finally, project results suggest a need to add design features to AAC technologies so that augmented communicators can access phones, take notes and communicate effectively in noisy work environments.

Table I. What is needed to make employment work for AAC users and their employers?

For the AAC user?	For the employer?
Support network including good personal care attendant services and reliable transportation	Ability to develop and identify jobs that provide a good match between client and expectation
Good communication and interpersonal skills	Knowledge of how AAC technology will interact with workplace technology
Marketable skills	Knowledge of relevant government policies
Effective and efficient assistive technology	
A strong work ethic	

Phase 2. In progress.

Methods. In this phase of the project, researchers are developing a website that will provide information about the supports and barriers to employment identified in the first phase. Ten individuals who use AAC and are seeking employment will provide ongoing feedback on the employment website. Researchers will use this information to modify the site over time.

TECH 2010: The learning experiences of AAC users with AAC technology

Tracy Rackensperger, Michael B. Williams, Carole Krezman, David McNaughton

The TECH 2010 project aims to document barriers and key supports to learning AAC technology and then to recommend improvements.

Learning AAC technologies: Consumer perspectives. In progress.

Methods. Seven AAC users participated in an Internet-based focus group discussion of their learning experiences with AAC technology.

Results and discussion: AAC users indicated they needed a wide variety of learning experiences to achieve mastery of an AAC device. No one learning technique was preferred by all. Some (but not all) liked using drill and practice techniques. Many felt observation of other augmented communicators using technology was helpful. Some, who used Prentke Romich products, noted the Icon Tutor and Icon prediction technology was useful. In addition, several expressed an interest in Internet-based learning experiences.

Learning AAC technologies: Parent views. In progress.

Continued on page 6

Penn State, Continued from page 5

Methods. Researchers conducted an Internet-based focus group for six family members of individuals who use AAC to ascertain information about the AAC technology learning experiences of their children.

Results and discussion. Parents of augmented communicators reported they sometimes had serious difficulties obtaining informed support from clinicians when selecting and learning to use an AAC device. They also said that a lack of instructional support had sometimes influenced their selection of AAC devices.

These data suggest a need to: (1) increase the number of informed SLPs and teachers who can provide assistance in developing the skills augmented communicators need to operate AAC devices effectively and (2) develop ways in which technology can better support the learning process.

Improving the design of AAC technologies for young children

Janice Light is directing a research project that considers various factors related to the design characteristics of AAC systems for young children. It includes a series of studies.

Children's Designs for AAC Technologies. Completed.

Janice Light, Laura Pitkin

Methods. This study used a participatory design to determine characteristics of AAC systems that seven-year-old children without disabilities would include in an AAC device. Five children and two young adults, acting as facilitators, participated. No participant had previous exposure to AAC. The group completed a series of activities during a five-hour period in one day.

1.Initially, researchers presented the group with a problem:

Emily, a preschooler with significant physical disabilities cannot talk and she wants to communicate with her mommy, daddy, brothers and sisters and with the kids and teachers at her preschool.

2. Participants then discussed things children Emily's age might want to say and do.

3. Researchers then gave the group a box of low-tech materials (*e.g.*, chalk, blackboard, scissors, clay, tape, posterboard, paper, pencils, cardboard boxes, rubber bands, construction paper, markers, crayons, glue and Legos) so they could design ways for Emily to communicate.

4. At the end of the day, the group presented their ideas and prototypes.

Data collection consisted of videotaping the design and presentation phases and collecting participants' notes and drawings, which researchers then transcribed and analyzed.

Results and discussion. These young children developed a multimodal solution to the problem posed, incorporating a variety of means to facilitate "Emily's" communication. In sharp contrast to many existing AAC technologies, the children designed systems that integrated a variety of functions—communication, play, telephone, a robot and a "drink machine." Also, the systems they designed looked "cool" and were quite decorative.

Outcomes. Children design AAC systems that are "fun" and have lots of decorations and allow for the integration of multiple functions. These features do not currently exist in the AAC devices available to young children today. Thus, these results have important implications for manufacturers, developers and service providers. Researchers recommend:

1. Developing more decorative designs for young children's AAC systems and evaluating these designs in terms of their appeal and long-term satisfaction.

2. Exploring and evaluating strategies to integrate play environments into communication systems.

3. Exploring and evaluating the use of AAC systems as early language learning environments, especially for children who have difficulty independently exploring the environment.

4. Replicating this study with other population groups (*e.g.*, individuals with ALS, young adults with cerebral palsy, children who are ambulatory) to identify new directions for effective AAC system designs.

Comparing the learning demands of four different approaches to the organization and presentation of language in AAC technologies: Study of three-year-olds. In progress

Janice Light, Kathryn Drager, Brittany Larsson, Laura Pitkin, Gini Stopper

Methods. This study investigated difficulties three-year-old children face when learning to use AAC devices. Researchers compared four approaches:

1. **Taxonomic grid using a menu page with symbols**. Vocabulary presented in a row-column layout organized taxonomically (*i.e.*, using hierarchical categories such as people, places, food). Menu page with symbols to represent each page (*e.g.*, a symbol to represent "people page").

2. **Schematic grid using a menu page with symbols**. Vocabulary presented in a grid organized schematically (*i.e.*, groupings of the people, actions, objects *etc.* that occur within a context such as circle time at school, going to bed, snack time). Menu page with symbols to represent each page (*e.g.*, a symbol to represent "eating page").

3. **Schematic grid using a menu page with screen shots**. Vocabulary presented in a grid organized schematically. Screen shots of the actual pages were used on the index page to reduce the memory demands of the system.

4 **Schematic scene using menu page with screen shots of actual system pages**. Vocabulary presented in an integrated scene organized schematically (*i.e.*, an actual picture of the environment with items preprogrammed under "hot spots" in the scene). Menu page with screen shots of the pages.

Researchers programmed 60

vocabulary items into each system on four pages. An index page provided access to the vocabulary on other pages. Forty children participated—ten in each condition. Each child was introduced to 18 target vocabulary items over a series of four learning and testing sessions within a play context—a birthday party scenario. Generalization also was assessed.

Results and discussion. Researchers have collected data for a total of 30 (of the 40) typically developing three-year-old children and is in progress for the remaining 10 children.*

Study of four- and five-year-olds. In progress.

Janice Light, Kathryn Drager, John McCarthy, Suzanne Mellott, Arielle Parsons, Craig Parrish, Stacy Rhoads, Maricka Ward, Michelle Zeevalk

Methods. These studies are investigating the learning demands for four-year-old children and five-year-old children using a similar approach to the three-year-old study. Researchers compared four approaches: Taxonomic grid, schematic grid, schematic scene and iconic encoding. The taxonomic grid, schematic grid, and schematic scene conditions were similar to the three-year-old study. In addition, the researchers investigated the learning demands of iconic encoding or a Minspeak-based approach. A total of 80 typically developing children participated (40 four-year olds and 40 five-year olds.) Ten children in each age group were randomly assigned to one of the four organization conditions and introduced to target vocabulary items structured around a birthday party theme (24 items for the four-year-olds and 30 for the five-year-olds) over four learning and testing sessions. Half of the vocabulary items were concrete concepts and half were abstract concepts. Generalization also was assessed.

Results and discussion. Data collection and analysis are nearing completion. Based on the preliminary results of the studies of three-, four- and five-year olds, young children without disabilities appear to have a very difficult time learning to locate vocabulary within the organizational frameworks available to them in today's AAC devices.*

This study was recently expanded to include a spin-off study designed to compare the performance of five-year-old children using iconic encoding *with* icon prediction to their performance using iconic encoding *without* icon prediction, to measure the impact of icon prediction on the learning demands of iconic encoding systems for young children.

* Preliminary results for completed sections of these studies were disseminated at the 2000 ASHA Convention, the 2000 ISAAC Biennial Conference and in *Augmentative Communication News* (v. 12, #6).

Investigation of the semantic organization patterns of young children. Completed.

Karen Fallon and Janice Light

Methods. Researchers studied how typically developing four- and five-year-old children would organize familiar vocabulary items (nouns, verbs, descriptors, prepositions, pronouns and question words) into groups when asked to sort 42 pictures, and whether their performance would be consistent over time.

Results and discussion. Analysis of the data revealed that most children (90%) used some organizational strategy in sorting at least some vocabulary items. The children tended to organize items in pairs or small groups (*e.g.*, "make" and "blocks"; "juice" and "cookies") rather than in large groups or pages and they had more difficulty arranging abstract concepts than concrete ones. An overwhelming majority of the items (93%) were organized according to a schematic organization (*i.e.*, people, actions, and things that occur together within the same context or event). Only 6% of the items were organized taxonomically (*e.g.*, food, people, places).

Outcomes. The results of this study have implications for designers and developers of AAC technologies and for service providers who work with young children. For example, the children showed a strong tendency to organize vocabulary based on events within their lives. This suggests that a schematic organizational strategy may help children access more vocabulary, more efficiently. In addition, children organized vocabulary in small groups or pairs. This suggests that AAC devices that are designed to enable children to access small groups of vocabulary within larger groupings or pages may be easier for them to use.

Future directions

The researchers recommend considering the use of graphic design features (*i.e.*, colors, borders) to help make smaller units more salient. In addition, they suggest replicating this research with other population groups. Finally, they feel that reliable and valid clinical procedures should be developed to assess the semantic organizational strategies of young children.

Continued on page 8

Penn State, Continued from page 7

Temple University

Temple University Projects

Diane Bryen, AAC-RERC Project Director at Temple University, works with Kevin Cohen, as well as Allison Carey and Jo Watson before her return to Australia to evaluate the efficacy of employment training for augmented communicators. They also manage ACOLUG, a listserv for augmented communicators. David Chapple, Leigh Ann Light- holder, Paul Pecunas, Solomon Rakhman and Bob Williams serve as consultants.

ACETS

Diane Bryen, Kevin Cohen

Augmentative Communication Employment Training and Support, or ACETS, is an employment-training program designed for people who use augmentative communication.

Methods. The ACETS curriculum was developed with input from augmented communicators and potential employers. For the past two years, researchers have conducted ACETS as a week-long intensive training program at Temple University, followed by a year of e-coaching. To date, eight augmented communicators have participated in ACETS.

The technical component of ACETS training focuses on sharpening computing and Internet skills to make participants more marketable in their chosen areas of interest. Training also focuses on developing skills related to the challenges of obtaining and maintaining employment (working with OVR, SSI, financial planning and small business planning; developing resumes; expanding interviewing skills and increasing job searching skills). Each participant completes the one-week intensive on-site program and leaves with a career plan and well-articulated action steps leading to an overall career goal.

Results and discussion. After two ACETS trainings, results have demonstrated that participants improve in their technical and job-related skills. In addition, 50% are now working part-time and have increased their monthly incomes. One participant has secured a full-time job.

Barriers to employment faced by most individuals who use AAC include: (1) a lack of literacy skills needed for many jobs, (2) a lack of previous job experiences, (3) limited expectations and (4) minimal preparation for the world of work. In addition, the supports necessary to obtain and maintain employment (*e.g.*, on-site personal assistance services and supported employment strategies for people who use AAC) are often lacking.

Outcomes. While ACETS has been effective, researchers feel that ACETS training should be made available to augmented communicators at younger ages and become part of a high school transition curriculum. Researchers will field-test ACETS at Widener Memorial High

Table II. Top 20 most frequently discussed topics on ACOLUG

AAC device issues (*e.g.,* choosing the right AAC system, device-specific questions, speed, technical questions, AT evaluations, upgrading, device access issues.	School issues , *e.g.,* AAC and literacy, IEPs, policies about AAC use, use in regular education classes, kindergarten, young children and AAC devices, costs, speech therapy.	Social and ethical issues, including who speaks for a nonspeaking adult with a signficant developmental disability, right to die, LAM, should vendors provide AAC evaluations.	Conference/workshop/camp information, including, ISAAC, PEC, ACES, Closing the Gap, Camp Chatterbox.
Funding for AAC devices, including Medicare.	Employment, employability, effects on benefits, virtual offices.	Society and AAC, including effect of AAC on the lives of users, discrimination, love and marriage.	Questions from SLP members, including caseload, evaluations, device-specific questions.
General technology issues, e.g., phone access, cell phones, computer and mouse use, virus alerts, Windows ' 98, screen readers, Dragon Dictate, Naturally Speaking.	Employment Forum including "Designing your own web site," "Can I afford to work?" "Building a successful small business," and Rights and responsibilities in employment under the ADA.	Living independently, including eating and drinking, transportation, air travel, personal assistance, CP and aging, getting own apartment, Hoyer lifts, use of diapers, travel and renting a wheelchair.	RERC-related, including, Demand-Pull conference, SSI Benny and so on Resources , including books on disabilities, scholarship information.
Health and safety issues including, abuse, Baclofen pump.	Parent concerns and questions, including evaluations, funding, choosing vocabulary, use in school .	Politics and action alerts, including the passage of the Hate Crimes Bill, Presidential election, voting access, encouraging members to vote.	Member-related communication including the death of an ACOLUG member, college graduation, map of members, greetings, birthday wishes.
Cognitive testing of AAC users.	Transportation-related, including airline travel.	Media commentary King Gimp.	Appropriate language use, including cursing. Minspeak as a foreign language.

School in Philadelphia during the 2001-2002 academic year. Students who are augmented communicators, as well as some of their peers, will participate for two hours each week beginning this fall.

ACOLUG

Diane Bryen, Kevin Cohen

ACOLUG was originally established by the Institute on Disabilities at Temple University in 1997 as an Internet listserv. Today, ACOLUG is an online community where information is exchanged, friendships forged and wisdom shared.

Methods. The ACOLUG listserv has more than 400 members from all over the United States and across the globe. ACOLUG is supplemented by a website www.temple. edu/inst.disabilities/ACOLUG where members can "meet" each other, review archives and obtain information. In addition, ACOLUG has sponsored an employment forum to address employment-related questions, develop marketable skills and enable AAC users who are successfully employed to mentor others.

Results and discussion. Since ACOLUG joined the AAC-RERC in April 1999, between 84 and 445 messages have been posted each month. During a 23-month period, 6,907 individual messages were posted (mean=303/month). Conversational topics discussed online vary widely. The most frequently discussed topics are listed in Table II on page 8.

Outcomes. A major outcome of ACOLUG is the establishment of an active virtual community for people who use AAC and their allies. ACOLUG has been an exceptionally successful platform for sharing information, teaching and learning online and supporting the employment efforts of augmented communicators. In addition, ACOLUG members often respond to requests for technical assistance from AAC users, parents and clinicians and discuss ethical issues and politics.

Additional projects

In addition to the projects funded by the RERC, smaller related projects are in progress at Temple.

Employment-related vocabulary. Through focus groups, Temple researchers are identifying employment-related vocabulary and plan to make these available on disk or on a website so augmented communicators can download the specific vocabulary they need.

SSI Benny. This online service will enable a person with a disability, who is an SSI or SSDI benefit recipient and wishes to work, to determine how earnings will affect his or her overall income and cash benefits.

Web access and AAC users. Before his untimely death, Leonard Kasday was working on a white paper and an online service addressing AAC use and access to the World Wide Web. Partners of the AAC-RERC are continuing this work.

Leonard Kasday with AAC-RERC colleague Jo Watson

In Memory of Dr. Leonard Kasday

In May 2000, the Institute on Disabilities at Temple University, the AAC-RERC and the worldwide disability community lost a valuable asset and an incredible human being. The untimely death, from a heart attack, of Dr. Leonard (Lenny) Kasday cost us the important services of a gifted technician and the collegial presence of a warm, caring human being.

Kasday was a pioneer in web accessibility. After a 20-year career as an engineer with AT&T, he joined the Institute on Disabilities as a Universal Design Engineer to work primarily on Web accessibility and Section 508 standards. His work with the AAC-RERC focused on use of the WWW and how to make it more accessible to people with significant motor disabilities, especially those who use AAC.

A student assistantship program has been established in his memory to further his important work.

For more information about the Leonard Kasday Student Assistantship in Promoting Web Accessibility, contact Diane Bryen at dianeb@astro.ocis.temple.edu or 215-204-1356.

University at Buffalo

University at Buffalo projects

Evaluating and enhancing communication rate, efficiency and effectiveness

With his colleagues at the University at Buffalo, Enkidu Research, Inc., and other universities, AAC-RERC Project Director, Jeffery Higginbotham is developing tools to collect and analyze communication performance and to study how speed and other temporal features of AAC technologies influence listener comprehension and perceptions of conversational interactions.

Effect Of speech rate on the comprehension and subjective judgments of synthesized narrative discourse. Completed

Kyung Kim, Jeffery Higginbotham, University at Buffalo; William Gavin, University of Colorado-Boulder

Slow communication rates impose significant barriers on the ability of speaking partners to perceive and comprehend utterances produced by people using AAC devices. This study investigated (1) the effect of speech rate on comprehension and (2) the effect of speech rate on the subjective judgments of speaking partners regarding synthesized narrative discourse.

Methods. Fifty able-bodied individuals first listened to natural speech stories and then listened to five synthesized stories (female MacinTalk Pro) at five different speech rates. After listening to each story, listeners answered multiple-choice comprehension questions and gave their subjective judgments about the synthesized narrative at each rate by responding to a questionnaire.

Results and discussion. As shown in Figure 1, comprehension scores increased significantly between 8.75 and 17.5 words per minute (wpm), were stable between 17.5 and 35 wpm, and then improved at 70 wpm. Scores declined between 70 and 140 wpm.

Analysis of subjective judgments revealed that listeners rated their experiences in listening to synthesized speech more positively as rates increased, except for a slight downward deflection between 70 and 140 wpm. Results also indicated that slowing the speech rate to 70 wpm significantly improved comprehension even though listeners preferred speech rates that increased to 140 wpm. The slowest speech rate (8.75 wpm) was the poorest for both listener comprehension and subjective judgments.

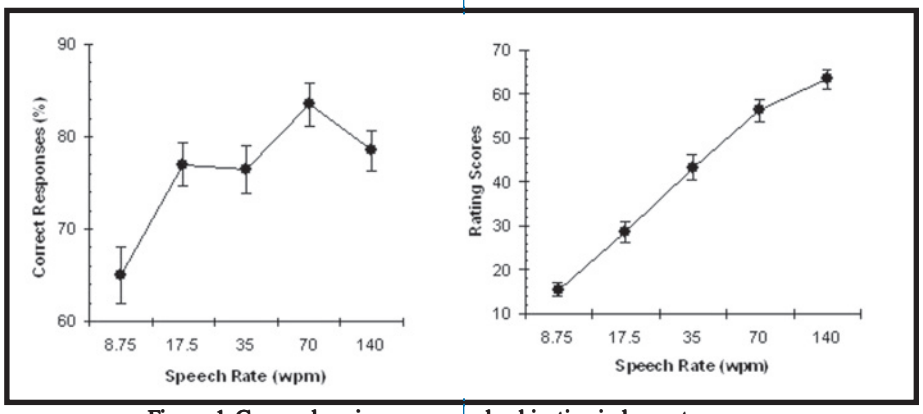

Figure 1. Comprehension scores and subjective judgments.

Outcomes. These results suggest that subjective judgments and comprehension measures may tap different issues. However, results provide clear, though limited, empirical evidence that faster AAC technologies may improve listener comprehension and perceptions of how competent a speaker may be. Given the finding that the slowest rates were most difficult for listeners to understand and were judged poorly as well, researchers will encourage the manufacturing community to include features in AAC devices that enable AAC speakers to sustain communication rates from 20 to 70 wpm during narrative discourse.

Computer facilitated evaluation of user-machine performance. In progress

Greg Lesher, Bryan Moulton, Rod Rinkus, Enkidu Research; Jeffery Higginbotham, University at Buffalo

Automated data logging (ADL) is the collection of human and device activity into a data file that can be analyzed empirically. ADL provides a permanent digital record, stores events in a time-series and allows for automated analysis. This project is developing logging methods for AAC devices and studying the validity and limitations of ADL for the collection and analysis of communication performance data.

Results and discussion. Researchers have completed a preliminary version of a universal logfile format (go to http://www.enkidu.net/logfile.html) that is powerful enough to support most common data collection requirements and provides an extendable framework for custom-

ized logging needs. In addition, they have developed the Augmentative Communication Quantitative Analysis (ACQUA) program to facilitate the analysis of logfiles (go to http://www.enkidu.net/acqua.html). ACQUA offers over 30 statistical tests and has the ability to: analyze multiple files, output to Microsoft Excel and statistical applications and analyze data at the machine event, user event, word, and sentence levels. During the past year researchers added additional features to ACQUA (*e.g.*, advanced filters, additional keystroke savings calculations, rate calculations based on direct, averaged, weighted or peak algorithms, time series and activity duration features that measure time spent between specific key activations).

In addition, researchers have developed an initial version of an augmentative communication device emulator (go to http://www.enkidu.net/enkidudemo.html) based on Enkidu's Impact program. The emulator is a reconfigurable AAC application that includes extensive logging capabilities.

Outcomes. Researchers have organized the RERC-Manufacturers' Working Group on Automated Data Logging. Participants include six corporations entities and six universities. Current discussions focus on specifying the function and structure of logfiles.

In addition, researchers are working on several performance projects involving ADL.

Production rate - Field methods Higginbotham, Lesher and Rinkus are collaborating with Pamela Mathy at Arizona State University to develop automated techniques to study the communication of AAC device users during every day communication activities. They are analyzing the files to determine device use over a one-week period.

Production rate - MinSpeak. Higginbotham & Sonnenmier (University of New Hampshire) are using ACQUA to analyze data from a longitudinal study of four individuals learning to use MinSpeak devices (50 hours of training).

Production rate - Scanning – Higginbotham & Moulton are studying the communication output of 15 participants who are learning to use AAC scanning systems. This represents the first multi-subject, long-term study of device acquisition. Each participant practices using two devices for 15 hours apiece. Data analysis will provide a test of the data logging and analysis programming and baseline measures for assessing communication rates.

Evaluating communication rates in interactive contexts. In Progress.

Jennifer Cornish, Jeffery Higginbotham

Methods. This project takes a comprehensive approach to measuring the temporal and content characteristics of interactive communication by taking into account both interactive and device-related phenomena unique to augmentative communication. Researchers used a digital video and the software package *Sound Forge* to collect, view and annotate data. Annotations include associated temporal information. Transcription with SoundForge markedly improves the efficiency (up to 75%) and precision of the transcription. See Figure 2.

To date, investigators have obtained data on three augmented communicators and their natural speaking partners during different communication activities (lecture, conversation) and with different communication media (language board, electronic device, natural speech).

Results and discussion. The formulation and production costs associated with speaking for each of the three augmented speakers were analyzed. There was a moderate

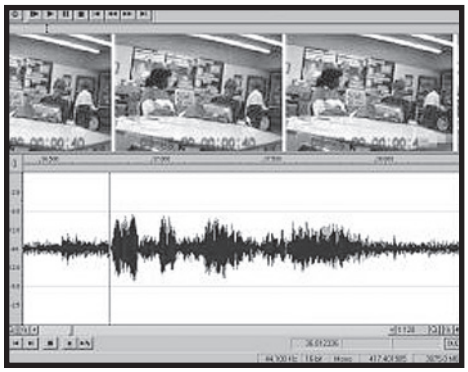

Figure 2. Screen shot of *Sound Forge*

correlation between duration and meaning units produced by the augmented speakers. No relationship was found for those measures for natural speakers.

Outcomes. *Sound Forge* provides a means to conduct a more meaningful analysis of the impact of communication rate on social interaction than the words-per-minute approach, which may grossly underestimate the augmented speaker's communication rate and cover up the temporal dynamics and each participant's contribution to the interaction. This approach enables researchers to account for an augmented speaker's message preparation time, as well as deal with speaker overlaps, message co-construction during conversation and information conveyed by a telegraphic utterance.

University of Nebraska

University of Nebraska projects

Project Director, David Beukelman, and other researchers at the University of Nebraska-Lincoln/Munro-Meyer Institute for Genetics and Rehabilitation at the University of Nebraska Medical Center are investigating the attitudes and preferences of adults with acquired disabilities and their communication partners toward features of AAC technologies. In addition, researchers are working on an AAC munu-based interface designed to minimize the demands on recall memory—so common in today's fixed screen and dynamic screen device interfaces— which persons who are elderly and those with recall memory limitations often find difficult.

Attitude Studies

Communication message formulation techniques used by persons with ALS. Completed

Laura Ball, Melanie Richter, David Beukelman, Cara Ullman.

Methods. Given the importance of storytelling in the communication repertoires of people as they age, this project investigated listener preferences toward three AAC storytelling strategies. Three groups of "listeners" participated: Nine adults with ALS, their caregivers, spouses or home health aides and 25 age-matched unfamiliar peers without disabilities.

Each participant viewed three videotapes of a man with ALS using an AAC device to tell stories word-by-word, sentence-by-sentence or using a full narrative presentation strategy. After watching each tape, participants responded to a Likkert-type questionnaire. They indicated their preferences regarding communicator competence, understandability and effectiveness, and listener comfort and willingness to listen. Results were compared across groups.

Results and Discussion. The full narrative presentation strategy was preferred. The word-by-word presentation strategy was always rated the lowest. Differences among preferences were statistically significant. These results suggest a need to develop features within AAC devices that enable augmented communicators to tell stories in ways that reflect their needs and that also take into consideration the preferences of their listeners.

Outcomes. The project demonstrated that people with ALS, their family members and unfamiliar partners prefer listening to stories when AAC users tell them in a full narrative presentation. They do not like listening to stories when they are told word-by-word. As a result, AAC-RERC researchers recommend that manufacturers include features into AAC devices that allow AAC users to (1) "capture" and store a message as it is told the first time, (2) retrieve and refine the story over time using AAC technology, (3) save different versions of the story and (4) tell stories using narrative production strategies.

Few AAC devices currently enable AAC users to capture and save stories when they are first formulated. This design feature could be a great asset to individuals who use AAC devices and wish to tell stories. In addition, adult AAC users who do not tell stories but may wish to, and those who routinely tell stories using a word-by-word strategy should be shown how to preprogram stories in their devices and release them from memory as a full narrative.

Communication modes used by persons with ALS. Completed

Melanie Richter, Laura Ball, David Beukelman, Joanne Lasker, Cara Ullman

Methods. This study investigated listener preferences toward modes of communication for storytelling. Three groups of "listeners" participated as subjects: Ten persons with ALS, eight caregivers, spouses or home health aids and 27 unfamiliar peers. Researchers prepared nine stimuli videotapes for the project. In each tape *Mr. Smith*, a 41 year-old male speaker with ALS (two years post diagnosis), used one of three modes of communication to tell three different narratives: (1) natural speech, (2) a communication notebook and (3) an AAC device with synthesized speech (EZ Keys on a Freedom 2000 from Words +, Inc.). At the time of the videotaping, *Mr. Smith's* speech intelligibility was measured at 70%. He reported using natural speech with very familiar listeners in some situations but relied on an electronic AAC device most of the time.

"Listener" participants viewed the three videotapes and responded to five statements on a questionnaire after each tape. Following the third tape, the subjects ranked their preferences for the three communication modes.

Results and Discussion. Participants' responses to the statements were as follows:

1. *Mr. Smith is a competent communicator.* All groups felt that he was more "competent" when he used the notebook and synthesized speech than when he used his natural speech.

2. *Mr. Smith communicated the story*

effectively. Care providers and peers said he was most "effective" when using the communication notebook. Persons with ALS said he was most effective when using synthesized speech.

3. *I would feel comfortable talking with Mr. Smith.* All groups were least "comfortable" when he used his natural speech and most comfortable if he used a communication notebook or the synthesized speech.

4. *If I met Mr. Smith using this system, I would be willing to participate in a storytelling conversation with him.* All groups were more "willing to participate" in a conversation when he used the communication notebook or synthesized speech.

5. *I understood the story told on this tape.* All agreed that his natural speech was "most difficult to understand." Persons with ALS and care providers said synthesized speech was the easiest to understand. Peers, on the other hand, said the notebook was the easiest to understand.

In ranking their preferences, persons with ALS and their care providers preferred synthesized speech. However, peers preferred the notebook. Natural speech was least preferred.

Outcomes. This project suggests that persons with reduced intelligibility should strongly consider using either an AAC device or a communication notebook if they wish to tell stories. Manufacturers and service providers can help augmented communicators to tell stories by optimizing storytelling options on AAC devices and in communication notebooks/boards.

Menu-based AAC interface

AAC Menu interface for persons with memory and learning limitations. Completed.

Chih Yang Kang, David Beukelman

Methods. This project designed a prototype interface (the "AAC Menu Interface") to reduce the cognitive demands on AAC users. For his dissertation, Kang developed design specifications for the AAC Menu Interface and programmed the prototype in three different versions: orthographic, iconic, and graphic. Then AAC intervention experts judged how well the prototype reflected the design specifications. Finally, Kang compared the message retrieval efficiency and ease of use ratings of persons with traumatic brain injury using the new AAC Menu versus dynamic screen interfaces.

Results and Discussion. In general, persons with more severe cognitive limitations rated the AAC Menu Interface as easier to use than a dynamic screen interface. This was true whether or not the individual was more accurate and rapid using the AAC Menu Interface.

Persons with less cognitive limitations rated the two interfaces similarly with regard to ease of use. Their ratings also were independent of the accuracy and speed with which they used the interfaces. When forced to choose between the two interfaces, both groups said they preferred the AAC Menu Interface.

Learning AAC alpha-encoding under three conditions. Completed.

Ellyn Gregory, Melinda Soderman, Christy Ward, David Beukelman, Laura Ball

Methods. This study compared the accuracy with which 28 non-disabled young adults learned alpha-codes under three conditions: No instruction or practice, instruction in coding rationale and error-free practice using either keyboard or mouse access to the AAC Menu Interface.

Results and discussion.

Condition #1. No instruction/no practice. In this condition, researchers told participants only that the alpha code for each target word would be three letters long. Performance (mean percentage of correct responses) for the computer mouse group was 30% and the computer keyboard group was 28%.

Condition #2: Instruction in coding rationale. In this condition, researchers informed participants about the rationale for assigning codes to each target word. The performance for the computer mouse group was 52% and for the computer keyboard group was 52%. Again, participants in the two groups performed similarly.

Condition #3: Error-free Practice. In this condition, participants practiced lists of words that contained the target words using the AAC Menu application with the following results.

Mouse. During the practice session the code letters were underlined in AAC Menu but did not have to be selected and participants made no errors. After the practice session, a target list of words was read aloud and participants wrote the codes on a sheet of paper (similar to conditions #1 and #2.) The mean percentage of correct codes of the Computer Mouse Group was 58%.

Keyboard. During the practice session participants retrieved the practice words by typing the letters highlighted in AAC Menu Interface and made no errors. Researchers then read aloud a list of target words and participants wrote the codes on a sheet of paper. The mean percentage of correct codes for the keyboard group was 88%. This group was statistically more accurate than the mouse access group.

Research involving persons with traumatic brain injury using the same protocol is underway.

Comparison of rate and accuracy in two AAC devices

Molly Hoegh, Denise Bilyeu, David Beukelman

Methods. This single case study compared the speed and accuracy of a 9-year-old with cerebral palsy learning how to retrieve vocabulary from an AAC device using the AAC Menu Interface versus the child's current system, *i.e.*, the Vanguard system (Prentke Romich Co.).

Results and discussion. During the study the child's speed and accuracy in retrieving familiar words was slightly better with the Vanguard than with the AAC Menu. However, for unfamiliar words, the child's performance using the AAC Menu was much more accurate and rapid.

Outcomes. The results of the AAC Menu studies have demonstrated the efficacy of using a menu-based AAC interface with some augmented commu-

Continued on page 14

University of Nebraska Cont. from page 13

nicators. In addition, results show that the AAC Menu Interface provides an essentially error-free learning strategy for individuals who use AAC devices.

Additional studies are planned. One study will compare messaging accuracy and rate using AAC Menu Interface and DynaVox interface (DynaVox, Inc.) by persons with aphasia due to stroke.

In memory of Bob Tice

Bob Tice's sudden death from a heart attack this spring stunned his colleagues at the University of Nebraska, the Munroe-Meyer Institute and the AAC-RERC. He leaves a void in the lives of students, faculty and the disability community. Bob was an expert application and systems programmer and a visionary who "kept his feet on the ground" while staying on top of a rapidly changing computer-programming environment. He is remembered for his many accomplishments including computer software that is widely used today, for the creativity and steadfastness with which he took on projects and for the humor, integrity and grace with which he lived his life.

Bob Tice with Dave Beukelman

University of North Carolina

University of North Carolina-Chapel Hill Projects

Improving literacy technologies for school-age children with severe physical disabilities

Janet Sturm and David Yoder co-direct two projects that address the improvement of literacy technologies for children with severe physical impairments (SPI). Both projects are ongoing and have a research and development focus. In the first project, researchers are developing an integrated literacy software tool that will provide students with SPI access to tools that enable them to participate in the general education/writing curriculum. The second project targets the development of a reading comprehension assessment tool for children with severe speech and physical impairments (SSPI).

Writing software tool

Methods. In preparing to develop an integrated literacy software tool for students with SPI, researchers have: (1) conducted a survey of literacy curricula across grade levels to identify reading and writing activities and materials as a function of grade level; (2) verified needs across grade levels (using the ratings of a team of experts) and examined existing software tools regarding software specifications, interface layout, and writing processes and (3) conducted research in kindergarten and 1st grade classrooms to identify writing topics, genres, pictures and vocabulary.

Reading and writing instruction across grades: A summary of literacy activities of general education classrooms. In progress.

Janet Sturm, Stephanie Spadorcia, Jim Cunningham, David Yoder, Kathleen Cali

Methods. This study represents the first broad, cross-sectional review of both reading and writing instruction across grades. Researchers examined the literacy activities of students and teachers in grades 1, 3, 5 and 7 to determine how teachers engage in reading and writing instruction and how students participate in literacy events at different grade levels. In addition, the project identified types of reading materials and writing genres used by students across the grade levels. Six school districts in New Hampshire, North Carolina, Texas, New York, Iowa, and Illinois participated in the survey project. A total of 875 surveys were disseminated to teachers; 283 were returned (32% response rate). The literacy activities survey contained questions about a range of reading and writing approaches (skill-based, holistic, balanced) and patterns of instruction across grade levels.

Results and Discussion. Researchers found grade level differences in the types of activities, literature used, and writing genres composed at each grade level. For example, instruction targeting recognition of high frequency words decreased in frequency across 1st, 3rd, 5th, and 7th grades (126, 61, 36, and 19 times per year, respectively). Another finding indicated that frequent, new writing topics paired with drawings are important in first

grade. First grade students produced 85 new writing topics each year and generated 100 drawings in their writing activities. These repeated writing opportunities provide solid building blocks for success in literacy learning.

Outcomes. Based on data collected, researchers have outlined core software specifications and identified content for all grade levels. The literacy tool, as currently proposed, has a universal design, is useful for typically developing and learning disabled students, and is accessible to students with physical disabilities. The tool reflects exemplary educational practices and utilizes cognitive models of the writing process. As currently proposed, the writing software tool would provide augmented communicators support across all phases of the writing process and offer family members, clinicians and educators a software tool that is easy to setup and program and that supports a writing curriculum. Researchers feel additional research is necessary to:

1. Examine communication patterns and vocabulary use across a range of literacy activities.

2. Design the display of vocabulary in AAC devices to facilitate participation in literacy activities.

3. Understand how to best display information (vocabulary, choices, tools) on a software interface for students with a range of cognitive, language, motor and sensory needs.

4. Provide access to the literacy curriculum for students with a range of cognitive, language, motor and sensory needs.

5. Better understand the integration of technology and literacy instruction to support literacy learning for students who use AAC.

6. Support AAC communicators in building personal background knowledge, accessing it and sharing this information.

Writing topic choices, drawings and vocabulary patterns of kindergarten and first grade students. In progress

Janet Sturm, Kathleen Cali, David Yoder

Methods. A total of 114 kindergarten and first grade students from a wide range of ethnic and socioeconomic backgrounds participated in a study designed to examine the types of writing topics, drawings and vocabulary used in kindergarten and first grade. Teachers collected between two and five writing samples from each student over a ten-week period, resulting in over 500 writing samples. Researchers will analyze these samples according to: (a) categories of writing topics; (b) relative frequencies of narrative and non-narrative genres; (c) categories of drawing topics; (d) relationships between drawings and writing topics; and (e) frequencies of word and phrase usage for each of the genres. These data will support the design of the writing software for students who use AAC in the early grades.

Reading comprehension assessment tool

Janet Sturm, David Yoder, Jim Cunningham, Karen Erickson, David Koppenhaver, Stephanie Spadorcia

A series of studies are underway to develop a reading assessment tool that will examine student capabilities in word identification, language comprehension and print processing. Researchers plan to maximize testing efficiency and accommodate for the significant barriers imposed upon children with SSPI by traditional assessments. A computer-based format will make it accessible to students with SSPI and help teachers and clinicians make instructional decisions for AAC users, such as selecting appropriate AAC technology and vocabulary to support literacy learning.

Validating the sentence-verification task as a measure of reading comprehension assessment.

Methods: The sentence verification task is ideally suited to children with SSPI because it requires only a yes/no response. This study will validate and provide information about the use of a sentence verification task (SVT) with typically developing kindergarten, first, and second grade students who will read stories at various grade levels and then respond to a series of yes/no comprehension questions that target a range of text knowledge (*e.g.*, topic, details or inference). Results of this study will provide statistical evidence of the validity and reliability of the sentence-verification task as a

Continued on page 16

ACN

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Univ. of North Carolina Cont. from page 15

measure of reading comprehension skills and will contribute to the larger project by providing necessary empirical evidence for the alternative assessment battery.