

NTID RESEARCH BULLETIN

Center for Research, Teaching and Learning • National Technical Institute for the Deaf • Rochester Institute of Technology

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Mike Stinson is a professor in NTID's Department of Research.



Barb McKee is an associate professor in the Department of Research at NTID.

C-Print Project Completes 10th Year

By Michael Stinson, Barbara McKee, and Lisa Elliot

For the past 10 years, a research and development group at NTID has been working to develop a speech-to-text classroom support system that we call C-Print. (The sound of the "C" is the same as the word "see" and indicates the system's real-time provision of print that can be seen; "C" is also the first letter for "computer," and reflects the system's computer-based operation.) Over these years, the group has made continuous improvements in C-Print and in strategies for implementing the system in high schools and colleges. The group also initiated nationwide training to C-Print captionists to support deaf and hard-of-hearing students, from Maine to California and from North Dakota to Louisiana. In this article we describe and reflect upon the emergence of C-Print from an idea to a system that hundreds of deaf and hard of hearing students depend on every day for classroom communication access and learning. In this article we take an historical perspective and consider four phases in the growth of C-Print. We also note some of the research evidence regarding C-Print's effectiveness.

Description of C-Print

The C-Print system involves a hearing captionist (transcriber) typing the words of the teacher and other students as they are being spoken. The system provides a real-time text display that the deaf student can read on a second laptop computer or a TV monitor to understand what is happening in the classroom. In addition, the text file is stored in the

computer and can be edited, printed, and distributed to students, tutors, and instructors after class.

Due to the speed of speech normally used by high school and college instructors (approximately 150 words per minute), the system cannot provide word-for-word transcription. Therefore, C-Print uses two means to achieve the goal of including as much of the relevant information as possible: a computerized abbreviation system to reduce keystrokes, and text condensing strategies. The system employs ordinary word processing software that is augmented with a set of phonetically-based rules for abbreviating words. Procedures for training captionists in using these rules have been developed. To deal with rapidly spoken lectures, the project team also developed text "condensing" strategies. The goal of these strategies is to reduce the number of words and abbreviations typed, while preserving meaning and keeping the message displayed as near verbatim as possible. (See *NTID Research Bulletin*, Vol. 1, No. 3, Fall 1996, for a discussion of earlier work on this project.)

Phases in Development and Implementation of C-Print

Work with the C-Print system has occurred in phases and has moved from (a) development of the system, to (b) research that has evaluated the system and yielded knowledge about best practices, to (c) national and international training that is facilitating widespread use of the system in educational programs.

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Notes of Note

A paper by **Susan Fischer** and Yutaka Osugi, "Thumbs up vs. giving the finger: Indexical classifiers in NS and ASL," has been accepted for presentation at the 7th Theoretical Issues in Sign Language Research conference to be held in Amsterdam, the Netherlands, in July, 2000. The paper compares structures in the sign languages of Japan (NS) and the US (ASL) with regard to classifiers for human beings and their interactions with verb agreement. Dr. Osugi is the new Executive Director of the Japanese Federation of the Deaf.

Fischer has also been invited to give a keynote lecture entitled "Towards a Typology of Sign Languages," at the 5th LP2000 (Linguistics and Phonetics) conference to be held in Prague, Czech Republic, in August, 2000. The theme of the conference is linear order in language. Fischer will be talking about the influence of modality of communication on language structure, drawing on her comparative research on ASL and NS.

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Technological Tools vs. Technological Ends (and the Art of Boat Building)

Hundreds of millions of dollars are being spent these days on the infusion of technology into education, at all levels and in all realms. Computers, digital cameras, scanners, videoconferencing systems, Internet hookups, dizzying varieties of software applications and educational programs — a “cyber frenzy” threatens to overtake us!

The danger of this frenzy is that it becomes a sort of fadism. The particular kind of fadism I mean here is the kind where something starts out as a means towards something, only to become an end unto itself. With reference to technology’s infusion into education, such fadism shows itself when educators commit time and money to incorporating technology in their work with students not because of its demonstrable effectiveness as a tool in supporting student learning, but because the school district or the federal government is making funds available to do so. After all, everyone else is doing it! The goal too quickly, too imperceptibly, becomes having and using technology not as a “learning support tool,” but as an end unto itself.

The work in this *NTID Research Bulletin* described by Stinson, McKee, and Elliot, and by Stuckless, represents a refreshingly different approach. Their collective focus is not on the technology itself, but on how to use the technology to support student access and student success. Their approach recognizes the fundamental reality that it is not technology itself that supports effective learning, but the way it is applied in supporting desired learning behaviors and ways of thinking that in turn generates effective learning. It is not

C-Print or ASR technology itself, but the ways these technologies are used by students and the teachers who work with them, that lead to improved access and learning.

As these articles indicate, the cost (or better yet, investment) of this “technology as tool” vs. “technology as end” approach is considerable, not so much in terms of expensive hardware or software but in terms of precious time and energy spent collaboratively between researchers and practitioners in problem-solving, assessing both intended and unintended results, speculating and innovating, and endlessly refining. But it is the only way to do it! Applying technology to education in a manner that actually makes a positive difference for student learning inherently represents a process of learning itself, not a process of reflexively slapping on this “automatic solution” to that identified problem. But as researchers and educators ourselves (that is to say, as learners), could it be any other way?

(Oh yeah, what’s all this got to do with boat-building? When a master learner like Ross Stuckless sets out to craft a cedar strip canoe in his life beyond NTID, you can be sure of one thing. His ideal vision of how that baby looks and handles in the water is what will guide his use of tools — doubtlessly in somewhat of a trial-and-error manner — and not the other way around. Ross will make sure his canoe-building technology, no matter how crude, will serve him as tools, not as ends!)

Jeffrey Porter
Interim Director, CRTL

NTID RESEARCH BULLETIN

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Opinions expressed in the *NTID Research Bulletin* do not reflect those of NTID or RIT. Your comments, questions, and requests for more information are welcome. See following address.

If you wish a copy of the *NTID Papers &*

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Marc Marschark, Director, CRTL
Gail Kovalik, Editor

Mike Stinson's research interests include the instruction of deaf and hard-of-hearing students in mainstream settings and the effects of technology, interpreting, notetaking, and tutoring. He is also interested in the social integration of deaf students who are mainstreamed and in the motivation of students in the classroom. In addition to research, he teaches in the Master of Science in Secondary Education of Students Who Are Deaf or Hard-of-Hearing program, which prepares teachers of the deaf. For more information, he can be reached at MSSERD@RIT.EDU



Lisa Elliot is a research associate in the Department of Research at NTID.

"In the third phase, C-Print was piloted in a variety of different kinds of sites. Implementation of the C-Print service was evaluated at eight sites.... Work in this phase focused on the development of policies and procedures for effective practice and implementation, and included the writing of an implementation manual."

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Phase 1: 1989-1993

The first phase focused on developing the initial C-Print system. The project developed the abbreviation dictionary, which initially had 2,500 words. We also developed the initial set of rules and materials for training captionists to use the abbreviation system. Major tasks during this phase were to determine whether the abbreviation system could be taught in one month and to conduct a limited trial with the system in the classroom (Stinson, Henderson, & McKee, 1992).

Phase 2: 1993-1996

In the second phase, the dictionary was expanded to approximately 5,500 root words and 4,500 associated suffixes for a total of 10,000 abbreviations. The abbreviation rules and the training materials were substantially revised so that individuals becoming C-Print captionists could more easily learn them. The system was used extensively as a support service in postsecondary classrooms, and the first trials in secondary classes were conducted. The effectiveness of the system was evaluated with respect to accuracy, amount of information captured, and student perceptions. The first workshop was provided to train captionists to use C-Print as a support in programs other than NTID.

Phase 3: 1996-1999

In the third phase, C-Print was piloted in a variety of different kinds of sites. Implementation of the C-Print service was evaluated at eight sites: one secondary program in New York, two secondary programs in California, three postsecondary

programs in New York, one postsecondary program in Connecticut, and one postsecondary program in Louisiana. Work in this phase focused on the development of policies and procedures for effective practice and implementation, and included the writing of an implementation manual which has been published (McKee, Stinson, Giles, Colwell, Hager, Nelson-Nasca, & MacDonald, 1999). C-Print training was also expanded to include other sites in addition to NTID.

Phase three included the most extensive research activity that has occurred during the whole 10 years of C-Print development. Although the considerable data collection has been completed, the analysis of these data, and the writing of reports, continues. This work has yielded new knowledge, including identification of effective strategies for students who use C-Print, and best practices for teachers. Students report that one of the most useful aspects of the C-Print system is the hard-copy notes that they receive after class. College students who used C-Print were asked to rate the helpfulness of the notes: "help little or none," "help enough," and "help very much." Thirty-three out of 36 students rated the notes as "helping enough" or "very much" ($p < .01$). Twenty-four out of 34 students responded that they used the C-Print notes more than the notes from the notetaker. This was also a significant difference ($p < .02$). Students used the notes in a variety of different ways. Twenty-nine said they skimmed, 16 used the notes to review unfamiliar vocabulary and ideas, 10 used notes to create their own outline, and 14 reported "other" uses, such as rereading (Stinson & McKee, 2000).

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Notes of Note

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For more information, contact Fischer at SDFNCR@RIT.EDU

Marc Marschark's article, "Interactions of cognitive processes and reading in deaf learners: Understanding differences," was recently published in J. Leybaert & G. Durand (Eds.), *Surdité et accès à la langue écrite: de la recherche à la pratique*, Actes du colloque international, volume 1 (pp. 95-109). Paris: ACFOS.

Marschark also recently has given several international presentations: "The interactions of

language and learning by deaf students" at the Instytut Gluchoniemych i Ociemniałych (Institute for the Deaf) in Warsaw, Poland; "Language, cognition and deafness" to the Faculty of Psychology, University of Warsaw; "Cognition and language of deaf students: From laboratory to classroom," the keynote address to the Secondary and Postsecondary Education of Deaf Students Conference in Brescia, Italy; and "Knowledge, cognitive processing, and sensory

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Barb McKee's research interests include the measurement of student perceptions of courses and instructors, the impact of college on students, the characteristics of successful college students, and the formative and summative evaluation of courses and programs. For more information, she can be contacted at BGMERD@RIT.EDU

Lisa Elliot's research interests include the sociology of education, study skills, and the social and psychological development of adolescents and adults. Lisa has worked as a research associate on the C-Print project for the past four years. For more information, she can be contacted at LBENRD@RIT.EDU

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"Phase 4 began recently with two major goals. The first is to provide substantially increased opportunities for training for individuals who wish to become C-Print captionists, and to increase the use of C-Print services in secondary and postsecondary educational programs.... The second goal of this latest phase is to develop a system of certification levels for C-Print captionists. We hope such certification will promote an appropriate level of professionalism and will help ensure quality service."

Although the C-Print service was presented to classroom teachers as a benefit to their mainstreamed students, a number of teachers indicated that they began to appreciate the service for themselves and for other students in the classroom as well. For example, teachers reported using the C-Print notes for themselves to review what happened in class and to prepare exams. Teachers also used the notes with hearing students who were having difficulty with course material or who had been absent (Elliot, Foster, Stinson & Colwell, 1997). Several of the teachers suggested that C-Print was good to have in the classroom because it was another way to generate awareness about disabilities. Teachers also found that C-Print helped them to become better teachers:

...It made me think more about my teaching and my presentation...and if anything, it made me try to be more organized...it made me think more about what the other students in the classroom see, how clear my directions are for them, and the explanation of the content... So, if anything I think it helped me be more conscientious.

For the majority of teachers, having an additional adult (the captionist) in the classroom did not pose any problems. In fact, many teachers preferred the service because it was "invisible" and it required little (if any) modification of their classroom behavior. College professors related the least to the captionist; the professors generally chose to ignore the captionists in class. In contrast, several of the high school teachers appreciated having additional adults in the

room. For some of these high school teachers, captionists served as a resource, while other teachers just "appreciated the captionist's company." Captionists found that they were most satisfied in the classroom when they were acknowledged, received the hand-outs, and when the instructor spoke clearly and at a reasonable pace (Elliot, Foster, & Stinson, 1999).

Phase 4: 1999—

Phase 4 began recently with two major goals. The first is to provide substantially increased opportunities for training for individuals who wish to become C-Print captionists, and to increase the use of C-Print services in secondary and postsecondary educational programs. In order to increase the availability of training we have begun to establish a network of training sites throughout the United States, all of which include a local trainer. Seven of these sites have already provided a C-Print workshop, with many of these workshops supported by the Northeast Technical Assistance Center based at NTID. A new project funded by a federal grant supports nine additional sites that will participate in the National Network and provide training. NTID and the other training centers have now trained more than 130 captionists who are working in approximately 75 educational programs in the United States, Canada, and Puerto Rico. Altogether, these various centers will train hundreds of more captionists in the next few years. The Department of Educational Outreach at NTID has also been crucial in making training available.

The second goal of this latest phase is to develop a system of certification levels for C-Print captionists. We hope such certification will promote an appropriate level of professionalism and will help

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representation among deaf learners," an invited address to the Lindamood-Bell 8th International Conference on Dyslexia, Hyperlexia, and Autism: Disorders on the Language Processing Spectrum, Anaheim, CA. For more information, contact Marschark at MEMRTL@RIT.EDU

Jerry Berent and Bill Clymer (Department of Educational Resources) have developed a

"Supporting English Acquisition" (SEA) web site at www.rit.edu/~gpbnci/sea to serve as an online professional development resource for teachers of deaf and hard-of-hearing students. Its goal is to help educators promote students' English acquisition and literacy and to suggest applications from English language research for managing English in curriculum and test development.

In March, 2000, Berent demonstrated the SEA Web site as part of his presentation, "On-Line Professional Development for Supporting

ensure quality service. The certification system will be partly based on the certification system for stenotypists working in educational settings by the National Association of Court Reporters and on that for interpreters by the Registry of Interpreters of the Deaf.

Conclusion

The C-Print speech-to-text support service has grown from what was only an idea 10 years ago to a system that is being used internationally by more and more educational programs. In the early years, our work focused primarily on research and development of the system, whereas it now focuses primarily on dissemination and training. The growing acceptance of C-Print reflects the system's educational benefit to students, benefits that have been demonstrated and documented by research. The continuous revision and improvement of training materials and procedures, the development of a national network of training sites, and the collection and dissemination of information on best practices with C-Print have also contributed importantly to C-Print's growth.

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Editor's Note

Michael Stinson has just received a grant from the US Department of Education for a two-year Phase I Steppingstones of Technology Innovation project, "Development of Speech Recognition and Computer Communications as a Support for Deaf and Hard of Hearing Students." In this system, as the teacher speaks, a hearing intermediary, or captionist, dictates into the speech recognition system in the computer, which converts the dictated words of the teacher into text. The system provides a real-time display that the student can read to understand what is happening in the classroom. This new system follows logically on the footsteps of C-Print by using text "condensing" when the speech becomes very rapid.

English Acquisition" at the annual convention of Teachers of English to Speakers of Other Languages (TESOL) in Vancouver, BC, Canada.

Anyone interested in contributing a chapter to the SEA site may contact the site editors at GPBNCI@RIT.EDU

Harry Lang and **Bonnie Meath-Lang** presented a Plenary Session at PEPNet 2000, "Words Upon a Window Pane: Opening Doors for the Deaf College Student." In the early 1860s, a young deaf

college student at Yale, who would later become a leading American chemist, etched a poignant Latin phrase on the window of his dormitory room:

Perseverantia omnia vincit, or "Perseverance conquers all." Lang and Meath-Lang drew upon such stories from the life experiences of Deaf men and women in history to discuss implications for the success of Deaf college students today. For more information, contact Lang at HGL9008@RIT.EDU

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Ross Stuckless is a professor in the Department of Research at NTID.

"When ASR is used under controlled conditions such as dictation, and with favorable speaker characteristics and practice, ASR word accuracy may match the frequently advertised 98%. However, when most users' spontaneous speech is recognized, e.g., while teaching a class, accuracy is likely to drop off severely, to 80% or lower."

Where Do We Stand on Applications of Automatic Speech Recognition (ASR) in the Classroom?

by Ross Stuckless

This is the third in a series of NTID Research Bulletin updates on the status of ASR for applications with people who are deaf. The first article dealt with a brief history of ASR and how it fits in with other real-time systems for converting speech into text, specifically stenographic-based systems and C-Print. The second discussed some of the highlights of a 1997 symposium hosted by RIT and the University of Rochester, which focused on applications of automatic speech recognition with deaf and hard-of-hearing people.

What's new in the product line?

1997 was a breakthrough year of sorts for ASR software. Dragon Systems and IBM, the two leading ASR software developers, each came out with products that permitted the user to speak more or less naturally, i.e., to speak without the necessity of pausing between each word. Dragon and IBM named their products *NaturallySpeaking* and *ViaVoice* respectively. Two other products, *Voice Express* and *Free Speech* have come on the market more recently.

In 1999, IBM introduced its *ViaVoice Millennium* series, and Dragon Systems introduced its *NaturallySpeaking 4.0*. Both have been adapted to our faster PC's and have gained in accuracy. I've used and evaluated both, and the IBM product has a slight edge in accuracy.

Also, *ViaVoice* is the only product that has a Mac version. Michael Stinson of NTID's Research Department and Bob Taylor of our Science and

Math Department report excellent results using *ViaVoice* with the Mac PowerBook.

Some of the ergonomic limitations in the use of ASR are beginning to change also. We are no longer of necessity "wired" to our computer by a headset. Wireless infrared headsets permit us to move about as we speak — a virtual necessity for classroom teachers.

Don't like to wear a headset? On my desk, I have a digital microphone that works marginally well at a distance of three or four feet, so long as I speak in its direction. Unfortunately, compared with the conventional wired headset, both the wireless systems and the desktop microphone forfeit some accuracy.

What hasn't changed?

With a simple enrollment procedure, several speakers can use the same ASR product. Each creates his/her own speaker file, and must open that file in order to be recognized. However, none of these products can recognize a change in speakers without first shutting down, loading the new speaker's files, and restarting the system. In short, they remain "speaker dependent." For most practical purposes, this precludes their application for conversation and other real-time verbal interactions, e.g., classroom discussion.

Nor does the ASR conversion of speech into text necessarily mean the text will be readable. Unless the speaker deliberately inserts punctuation, e.g., says "period," the text will appear simply as a string of words. Similarly, the speaker is responsible for saying "new paragraph" and other such commands when called for, in order to improve readability (Stuckless, 1999).

When ASR is used under controlled conditions such as dictation, and with favorable speaker

Gail Rothman-Marshall, Chair of Counseling Services at NTID, has just been awarded an RIT Provost's Learning Innovations Grant to develop a CD-ROM/web multimedia workbook and study guide to supplement the NTID sections of her Introduction to Psychology course. Designed to meet the needs of deaf learners, and using Blackboard CourseInfo software, Rothman-Marshall will place tutorials, simulations and media

files on the CD-ROM; practice questions, course syllabus, calendar, lecture notes, online quizzes, etc., will be on the Web. The format will support student-to-student and -teacher interactivity. For more information, contact Rothman-Marshall at GARNCD@RIT.EDU

A member of the senior research faculty at NTID, Ross Stuckless began his career more than 40 years ago as an English teacher at the American School for the Deaf in Hartford, Connecticut, where his brother David was among his students. Ross is optimistic that future applications of automatic speech recognition will contribute substantially to the quality of life among

deaf children and adults, and others who share their lives. For more information on ASR, contact Stuckless at ERSNVD@RIT.EDU

characteristics and practice, ASR word accuracy may match the frequently advertised 98%. However, when most users' *spontaneous* speech is recognized, e.g., while teaching a class, accuracy is likely to drop off severely, to 80% or lower. Incidentally, for steno-based systems, I've used 95% as an acceptable criterion for accuracy; no less should be demanded of ASR.

What's been done to adapt ASR for deaf students?

Recently, I tried an approach that I call *shadowing* to introduce ASR into the classroom. Instead of asking the teacher to be the user whose voice is being recognized, I trained a student assistant (an interpreter trainee) to use ASR and to repeat the teacher's words quietly into a Stenomask (see photo on p. 8). A second person who was already expert in the use of a Stenomask volunteered to participate as a shadower also.

Each of the two shadowers was given a videotape of a lecture which had been presented by a member of RIT's Liberal Arts faculty, and was asked to shadow it *verbatim*. The first shadower achieved an accuracy score of 59%, and the second achieved a score of 89%. Clearly the first score was unacceptable, and the second only marginally acceptable for the intended purpose. These findings led me to conclude that *verbatim* shadowing for classroom use is not feasible (Stuckless, 2000).

In the meantime, Michael Stinson has become interested in merging some of the properties of C-Print with shadowing and ASR, based on the production of *condensed* text instead of *verbatim* text. His goal here is to capture the most important points while using fewer words than the original speaker. Building on the merits of several communication technologies, he may be onto an important new service for deaf students.

Elsewhere, St. Mary's University, in Halifax, Nova Scotia, in partnership with IBM's Human Language Technologies Division, is working vigorously on identifying adaptations in ASR needed to support deaf students and students with other disabilities in the college classroom (described at www.liberatedlearning.com). Working together, they have a good prospect of achieving significant refinements in the adaptation of ASR for deaf students, particularly at the college level.

Under the aegis of R&D, in the early 1980's NTID introduced steno-based real time speech-to-text as a support service to many of our nation's mainstreamed deaf and hard-of-hearing students. In the early 1990's, NTID introduced C-Print for the same purpose. Both have become mainstay components for services to mainstreamed deaf students. I cannot imagine our defaulting on ASR.

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Gonna Build a Boat

Gail Kovalik asked me to say something on the eve of my retirement—just 150 words or so. So here goes.

Early in my career I was often asked what led me to become a teacher of the deaf. My answer was simply that I have a deaf brother. Career decisions are rarely that simple, or after more than 40 years in the education of deaf students, more lasting.

Will I miss NTID as a major part of my life? Will I miss the satisfactions that come from doing research that I like to think has significance for deaf students here at RIT and elsewhere? Will I miss seeing friends and colleagues on a daily basis? Of course I will.

Come July 1, Carol and I plan to do more together than 157 words can tell. And, oh yes, I really plan to build a boat, or more precisely, a cedar strip canoe named Hiawatha.

Editor's Note

Ross has been recognized by his NTID peers [full professors], NTID's Dean, and RIT's Provost by being appointed to the rank of Professor Emeritus at NTID, effective July 1, 2000.

“Under the aegis of R&D, in the early 1980's NTID introduced steno-based real time speech-to-text as a support service to many of our nation's mainstreamed deaf and hard-of-hearing students. In the early 1990's, NTID introduced C-Print for the same purpose. Both have become mainstay components for services to mainstreamed deaf students. I cannot imagine our defaulting on ASR.”

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What is the status of use of Automatic Speech Recognition (ASR) systems in the classroom? Carol Stuckless (right) models a Stenomask, used in shadowing a teacher's words with ASR. See the article on p. 6 by Ross Stuckless for a discussion of the topic.



IMPLICATIONS OF NTID RESEARCH

FOR DEAF AND HARD-OF-HEARING PEOPLE • NTID RESEARCH BULLETIN

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In 1993, the National Technical Institute for the Deaf established the Center for Research, Teaching and Learning. A primary mission of the Center is to "foster advances in teaching and learning that enhance the academic, professional, social and personal lives of people who are deaf or hard of hearing." Among its other functions, the Center both conducts research relevant to that goal and supports research conducted by colleagues from across NTID. As part of our collaborative efforts, the Center regularly undertakes the collection and dissemination of relevant research findings from across NTID. Included for each publication is a description of the implications of the research findings the author thinks will be most relevant for NTID's audiences.

Fischer, S., Delhorne, L., & Reed, C. (1999). Effects of rate of presentation on the reception of ASL. *Journal of Speech, Language, and Hearing Research*, 42(3), 568-582.

Isolated signs and ASL sentences were presented to 14 native signers at rates varying from 1 to 6 times normal speeds. Signers were asked to copy the signs or sentences on videotape. For the signers, accuracy dropped precipitously either between 2-3 times or between 3-4 times normal speeds. Also, error types shifted from more semantically or syntactically based to more formationally based as one went from lower to higher speeds. The rates at which the breakdown occurred are the same as for time-compressed speech, suggesting that there is an overall ceiling in processing rate which is independent of modality.

Implications:

The original work in time-compressed speech made it possible to make recordings for blind persons that could come close to matching the rate of reading vs. speaking. Theoretically, this research could mean that signed information could be sped up so that signers could get more information per unit of time than would be possible through natural speeds of signing. However, two

factors that limit the implications of this study must be kept in mind: first, all of our subjects were native signers, and native signers are but a small percentage of the population; second, longer narratives might be fatiguing as compared to relatively short sentences.

Metz, D., Caccamise, F., & Gustafson, M. (1997). Criterion validity of the Language Background Questionnaire: A self-assessment instrument. *Journal of Communication Disorders*, 30(31), 23-32.

D/deaf and hard-of-hearing college age students (N=231) took (1) an objective test of their sign language communication skills (the Sign Instruction Placement Interview/SIPI), (2) an objective test of their spoken communication skills (Write-Down Speech Intelligibility Test), and (3) a paper and pencil questionnaire which includes self-assessment items for sign language and spoken communication skills (Language Background Questionnaire/LBQ). The results showed a high degree of congruence between the objective measures of students' sign language and spoken communication skills and their self-assessments.

Implications:

Results of this study show that young

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D/deaf and hard-of-hearing adults are able to accurately self-assess their sign and spoken language communication skills. Self-assessments are not intended to supplant detailed diagnostic testing for educational and rehabilitation purposes. However, when general information about young D/deaf and hard-of-hearing adults' communication skills is what is needed, the simplicity, ease and economy of administration and interpretation of the LBQ supports its use, rather than the use of more time consuming, costly, and intrusive objective assessment approaches.

Foster, S., Long, G., & Snell, K. (1999). Inclusive instruction and learning for deaf students in postsecondary education. *Journal of Deaf Studies and Deaf Education*, 4(3), 225-235.

This article explores how deaf students and their instructors experience mainstream college classes. Both quantitative and qualitative procedures were used to examine student access to information and their sense of belonging and engagement in learning. Instructors discussed their approach to teaching and any instructional

modifications made to address the needs of deaf learners. Deaf students viewed classroom communication and engagement in a similar manner to their hearing peers, but were more concerned with pace of instruction and did not feel as much a part of the "university family" as did their hearing peers. Faculty generally indicated that they made few if any modifications for deaf students and saw support service faculty as responsible for the success or failure of these students. Results of these and additional findings are discussed with regard to barriers to equal access and strategies for overcoming these barriers.

Implications:

Emphasis should be given to the similarities between deaf and hearing students, and those instructional practices that enhance learning for everyone. Instructors should be selected for interventions who are interested and willing to modify their teaching strategies to facilitate inclusion of all students. Intervention strategies should be practical, reasonably easy to implement, and disseminated through user-friendly vehicles. And excellence in teaching should be rewarded.

If you would like to obtain information in an area beyond what you see listed, you can write to the first author of closely related papers, c/o NTID. If you are unable to obtain one of the publications on this sheet from your local library, you may send this form to: Educational Technology Resource Room, National Technical Institute for the Deaf, 52 Lomb Memorial Drive, Rochester, NY 14623-5604.

____ Fischer, S., Delhorne, L., and Reed, C. *Effects of rate of presentation on the reception of ASL.*

____ Metz, D., Caccamise, F., and Gustafson, M. *Criterion validity of the Language Background Questionnaire: A self-assessment instrument.*

____ Foster, S., Long, G., and Snell, K. *Inclusive instruction and learning for deaf students in postsecondary education.*

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