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Harry Lang is a professor in the Department of Research at NTID.

Do Adjunct Aids in Instructional Prose Make a Difference?

By Fred Dowaliby and Harry G. Lang

The potential of adjunct aids to improve learning from prose has long been recognized in the history of educating deaf students. "Pictures," wrote deaf educator James H. Logan in 1870, "besides the pleasure they give, act as definers of the text, and convey far more correct ideas than could be gained from the words alone" (p.97). As with his contemporaries, Logan did not have the tools available today for educational research. Yet, even in more recent times, there have been few such studies involving deaf subjects, despite the promise of adjunct aids to learners who rely primarily on the sense of vision.

At NTID, we have begun a series of investigations to systematically examine the benefits of embedding various types of adjunct aids, including pictorial displays, sign representations, and adjunct questions, in instructional prose. Our findings thus far show promise for improving the effectiveness of the text used in presenting technical information to deaf learners. Educators using computer assisted learning materials, including distance education and other courseware, stand to benefit from this program of research studies.

The difficulties deaf learners have with comprehending prose have long been documented. It has been reported that the lags of deaf students in reading comprehension relative to their hearing peers increase through the school years. By the time deaf students are in their late adolescence, their reading abilities approximate the average eight- or nine-year-old hearing student. It has been estimated that only eight percent of all deaf students enrolled in college read at the eighth grade level or higher, and the estimated functional reading level for minority deaf college students is even lower (Allen, 1994).

Unfortunately, reading comprehension lags in deaf learners have not changed much over the past thirty years. More than thirty percent of deaf students leaving school are functionally illiterate, compared with less than one percent of their hearing peers (Marschark, 1993). Analyses of the English grammatical knowledge of deaf students have shown delays in virtually every aspect of English syntax (e.g., Berent, 1988).

Basing our work on an established model for "mathemagenic activities," we set out to investigate the usefulness of adjunct aids under different conditions and with regard to various types of learning. Since the early 1960s, the study of mathemagenic activities and adjunct questions with hearing college students has received a great deal of attention (Rothkopf, 1996). Generally, mathemagenic activities are student behaviors that produce learning. Much of this work has been performed within the context and methodology of adjunct questions. Generally, adjunct questions either directly preceding or following pertinent instructional text have been shown to produce mathemagenic activities that "…are acts of rehearsal that strengthen memory…" (Rothkopf, 1996, p.885). These acts of rehearsal in turn have been shown to benefit the learning of question-relevant information.

We also studied the effects of using pictorial aids in the form of static illustrations and animation, which are frequently used in instructional materials. The early studies of illustrations used in printed

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John Albertini, **Ron Kelly**, and Nora Shannon (Master of Science in Secondary Education, NTID) presented a paper, "Reading college-level materials: Strategies used by deaf students," at the Sixth Annual Meeting of the Society for the Scientific Study of Reading, April 23-25, 1999, in Montreal, Quebec, Canada. The paper described classroom-centered research, indicating that NTID students with measured reading abilities at 9.1 grade level and higher benefited more from the reading strategies instruction than did students with measured reading levels at 7.5 grade level and below. For more information, contact Albertini at e-mail *JAANCR@RIT.EDU*

Frank Caccamise has been working since last summer on a collaborative project with the South Carolina School for the Deaf and Blind (SCSDB) to analyze their Sign Communication Proficiency Interview (SCPI) program. Based on this analysis, the school will refine its Staff Communication

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The Research Y2K Bug—Revisited

In the last *NTID Research Bulletin*, I wrote about a presentation I did last year on "the research agenda in deafness for the next 5 to 10 years." In both the presentation and the *Bulletin* column, I summarized input on the issue received from several educational and psychological researchers. As a reminder: In their view, the four greatest needs for research in the new millennium would/should be implications of new technologies (especially cochlear implants), investigations of the effects of early intervention programs, evaluation of bilingual/bicultural educational programs, and English literacy. Only one person mentioned research relating to teachers and teaching as a high priority, and it was perhaps this conspicuous outlier that led some members of my original audience to argue that I needed to step outside the ivory tower and solicit input from teachers and educational administrators. So I did.

"Among teachers of deaf students, the primary concerns focused on English literacy—ways to bridge from ASL to English, to improve reading, to overcome the abysmal language skills of deaf students in mainstream programs, and a desire to characterize the differences between high-literacy and low-literacy deaf students in hopes of finding something in the former group that could help the latter group."

In the interests of methodological rigor, I should note that I gathered the data for "Study 2" using the same qualitative paradigm as "Study 1": mostly e-mail solicitations with a few face-to-face interviews. The results of Study 2 were interesting and enlightening. First, somewhat to my surprise, I found that teachers were extremely enthusiastic about the question, offering to be involved in the research and willing to discuss the implications of alternative outcomes even before the research was designed. This was not the eye-rolling, tolerating, and patronizing behavior that I had expected based on what I have often encountered from instructors at NTID and Gallaudet. Second, in contrast to the 100% response rate from teachers, more than half of the school administrators I contacted did not respond to my request for information. While I hesitate to make much of this difference in response rates, I will touch on it later.

Before I do that, let's look at the responses. Among teachers of deaf students, the primary concerns focused on English literacy—ways to bridge from ASL to English, to improve reading, to overcome the abysmal language skills of deaf students in mainstream programs, and a desire to characterize the differences between high-literacy and low-literacy deaf students in hopes of finding something in the former group that could help the latter group. A close second were concerns about evaluating bilingual education programs, especially in terms of their long-term impact. From educational administrators, the potential impact of various technologies (cochlear implants, captioning, teleconferencing, etc.) took the lead, followed closely by concerns about "the demise of traditional programs [schools for the deaf]." Notice that, again, little was said about teaching, per se, although some related issues did emerge farther down in the priority list from the teachers, just as they had from researchers in Study 1.

More importantly, I think it is informative that the teachers and the researchers agreed on the need to focus on English literacy, both in its own right and in the context of bilingual programs, and that the administrators and the researchers agreed on the need to focus on the impact of new technologies. Perhaps most obviously, the results of my two informal experiments were consistent in suggesting that diverse researchers in the field—my original sample was an international one drawn from a variety of settings—are clearly on top of the issues of

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Marc Marschark, Director, CRTL
Gail Kovalik, Editor

"Clearly, the greatest challenge for research on the education of deaf and hard-of-hearing students is the sheer complexity of the matter."

"A variety of naïve investigators in the field of deaf education have already provided answers to questions that were ill-formed in the first place and often were explored using inappropriate or insufficient methodologies. Flawed conclusions from flawed research have not helped deaf students achieve their academic potentials, nor have they reflected positively on other researchers who are better trained and equally dedicated."

greatest concern to those involved in the day-to-day challenges of educating deaf students. Nowhere did I see even a hint of researchers being "off in their own little world," as is often suggested by non-researchers. Indeed, the fact that those few administrators who responded were as much, or more, concerned with preserving traditional educational models (their jobs or those of their friends?) as with determining what educational strategies might be most effective suggests that they might not be the best people to complain about progress in research.

This is not to say that research into the educational abilities/challenges of deaf students has achieved all (or most) of its goals. As I suggested in my previous column, however, I believe that research into the understanding of the language and academic abilities of deaf learners is now in a much better position than ever before, and that "Advances in educational theory, methodology, and technology, give us new avenues for the enhancement of educational opportunities for deaf and hard-of-hearing students." As I write this last of my *Bulletin* editorials before I step down from my administrative position to resume research and teaching, I therefore cannot help but take advantage of my soapbox—and the authority that allows me to go way beyond the word-limit normally imposed on me—to point out several implications of the above studies.

Clearly, the greatest challenge for research on the education of deaf and hard-of-hearing students is the sheer complexity of the matter. Most deaf children come from families in which there was little effective communication early on, limited exposure to competent language models, and a variety of social and experiential hurdles to overcome. I have argued in other places that these issues are all intertwined, and they undoubtedly have subtle and not-so-subtle influences on educational achievement. Beyond the content matter itself, a significant challenge to successful research in our field are the unrealistic expectations of those who employ and fund those of us who do educational research—expectations that seem to change often and ignore the fact that good research takes a lot of time, patience, and effort… and does not always provide politically correct answers.
A variety of naïve investigators in the field of deaf education have already provided answers to questions that were ill-formed in the first place and often were explored using inappropriate or insufficient methodologies. Flawed conclusions from flawed research have not helped deaf students achieve their academic potentials, nor have they reflected positively on other researchers who are better trained and equally dedicated. True, there remain researchers who are more concerned about their own issues and careers than in linking their findings to the everyday needs of deaf students. As a group, however, they are at least as sensitive to the challenges facing students who are deaf—and their teachers—as anyone else.

More to the point, as we have shown in previous *Bulletins*, research in our field has made incredible strides in the last two decades, even if we continue to be frustrated with a need for even faster progress. And what are our alternatives? There is no other segment of our educational system in which research and teaching have as much to offer each

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Philosophy, Policy and Procedures, including sign language communication skill level standards for SCSDB staff and staff applicants. The revised and updated documents will be submitted for approval at the May, 1999, SDSDB Board Meeting.

Harry Lang was invited to Pittsburgh, PA, on March 19, 1999, for a presentation on the "History of the TTY" as part of the Deaf Pride/ASL Series at the Western Pennsylvania School for the Deaf. On March 27, 1999, he was also invited to give the "Science Abled" breakfast presentation at the National Science Teachers Association to educators interested in teaching science to students with disabilities.

Ila Parasnis gave invited seminars, "Issues related to cultural and language diversity in deaf education," at Lamar University, Beaumont, TX, on February 5, 1999,

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"*The barriers between research and application were not built overnight, they will not be dismantled overnight, and they certainly will not be dismantled by demanding their abolition.*"

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other or are in as much need of each other. Are we to just give up on focused research efforts and tell school teachers and university faculty to see what research they can do in their spare time? Are we to limit the scope of research to the politically popular issues (or populations) of the day?

"*What we need is more than dialogues between teachers, researchers, parents, and educational administrators…. We need a multi-sided collaboration with a clear, commonly-agreed, and realistic agenda, not one dictated by a single side while ignoring the realities of the others. Alas, we are not yet there…*"

Yes, I know that these are the things of the real world; and I know that those who establish research and funding priorities are those who control the purse strings. Nevertheless, I wonder at the variety of meetings where non-researchers establish research priorities without regard to what is do-able or what is theoretically sound, in the interests of responding to the concerns of appropriate audiences. In six years as director of the Center for Research, Teaching, and Learning at the National Technical Institute for the Deaf (which includes the formal research unit of NTID), certainly I have never been invited to contribute my/our ideas to such prioritizing. It is only through my research and my writing that I have been able to have an impact—a much more direct one than I have had as an administrator—on teachers, parents, and deaf students.

The barriers between research and application were not built overnight, they will not be dismantled overnight, and they certainly will not be dismantled by demanding their abolition. What we need is more than dialogues between teachers, researchers, parents, and educational administrators [choose any two at a time]. We need a multi-sided collaboration with a clear, commonly-agreed, and realistic agenda, not one dictated by a single side while ignoring the realities of the others. Alas, we are not yet there; but I have seen significant progress as motivated teachers, parents, and investigators have side-stepped barriers, rolled up their sleeves, and gotten to work. No, not all of us, but enough to encourage me that we are making progress at an accelerating rate. I think I do understand the complex realities of the situation, and I am willing to take it one step at a time. All I ask is that, as Lee Iacocca is reputed to have said, please, lead, follow, or get out of the way.

Marc Marschark
Director, CRTL

[As mentioned in this editorial, Dr. Marschark will be stepping down as the first director of the Center for Research, Teaching and Learning at NTID, effective June 30, 1999, after six years in this position. During his tenure, Marc was instrumental in bringing together a group of disparate departments (including Research, Instructional Television, Instructional Design and Evaluation, the NTID Learning Center, and Educational Resources) into one cohesive and productive unit. But, as he says, "if research, teaching, and writing are what drive you (i.e., the "fun" part), it seems time for a change." Marc has been accepted into the NTID Interpreter Education program as a full-time student for the coming academic year, with a short-term goal of learning how interpreting works, "from the inside," by becoming a certified interpreter himself, a mid-range goal of doing research on interpreting, and a long-range goal of establishing a "center" for the study of sign language interpreting, utilizing external as well as internal resources. His enthusiasm and energy as center director will be missed! —Ed.]

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and at New Mexico State University at Las Cruces, NM, on April 8, 1999. She also gave an invited presentation at the El Paso Community College in El Paso, TX, for the National Multicultural Interpreter Training Project on multilingualism, multiculturalism, and communication in India, on April 7, 1999. For more information, e-mail Parasnis at *IMPNCR@RIT.EDU*

Ross Stuckless and Bob Davila (Vice President for NTID at RIT) were among 25 people nationally who were invited to participate in a policy forum in Washington, DC, last September to assist the Department of Education's office of Special Education Programs in reviewing federal priorities in support of services for deaf and hard-of-hearing children and youth, and to suggest priorities for future federal support. The proceedings, published in February, 1999, are available through the National Association of State Directors of Special Education.

An article by **Robert Whitehead**, N. Schiavetti,

All of Fred Dowaliby's degrees are in psychology, with special emphasis on educational psychology during his graduate training. Dowaliby has been actively interested in the moderating effects of individual differences on learning from instruction. His main current interest is multimedia instructional research. For further information, contact Dowaliby at FJDERD@RIT.EDU

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books have evolved over recent decades to include computer-based instruction. Studies using illustrations with text have shown how contiguity may enhance learning. Generally, the available studies indicate that some adjunct pictorial aids used under certain conditions may contribute to learning. More research is needed, however, to determine specific moderating factors. For deaf learners, traditionally recognized as "visual learners," the need for additional research on pictorial aids is particularly warranted.

In addition, we are looking at the use of adjunct sign language to enhance learning through prose. Several earlier studies have examined the association between text and graphic sign representations of the text, reporting that word identification task performance was improved with the use of adjunct sign language aids. However, studies comparing text (printed and captioned) and interpreted versions of spoken content have shown greater effectiveness in communication through the printed word.

"Generally, the available studies indicate that some adjunct pictorial aids used under certain conditions may contribute to learning. More research is needed, however, to determine specific moderating factors. For deaf learners, traditionally recognized as 'visual learners,' the need for additional research on pictorial aids is particularly warranted."

In our most recent study, "Adjunct aids in instructional prose: A multimedia study with deaf college students," which will be published in the *Journal of Deaf Studies and Deaf Education*, the effectiveness of three adjunct aids on direct learning were examined. We provided content movies, sign movies, and adjunct questions as redundant reproductions of the information presented by the instructional text. However, the additional purpose of the adjunct questions was to produce beneficial learner activities in the form of cognitive engagement with the instructional content. All materials were presented by computer, thus allowing a single presentation device for text and movies.

Method

This study involved 144 NTID students. A stratified random procedure was used to assign the subjects to one of three reading levels, based on a reading comprehension test, and to one of the five conditions investigated, so as to result in approximately equal cell sizes. Subjects in the Sign Movie and Full conditions were required to demonstrate sign proficiency.

The text of the eleven lessons consisted of unequivocal factual statements about the human eye, its function and care. Lessons ranged from one to three sentences (12 to 31 words), with grade-equivalent reading difficulty levels of the lessons ranging from 5.5 to 12 with a mean of 7.7. The multiple-choice adjunct questions and the correct response were verbatim reproductions of part or all of the lesson texts. These questions served as adjunct questions throughout the instruction for two of the instructional conditions and as post-test items for evaluating immediate factual learning for all conditions.

The sign movies were representations of the lesson text. English-like signing with American Sign Language features was used. The duration of each sign movie ranged from 15 to 44 seconds. The content movies were animated pictorials that exemplified the lesson content. They ranged from 2 to 21 seconds in duration.

There were five instructional conditions presented by computer. A different interactive digital movie was developed for each of the instructional conditions using the software program *Macromedia Director*. The Text Only condition presented only the text as instructional material. The Adjunct Question condition presented a multiple-choice question

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D.E. Metz and T. Farrell, "Temporal characteristics of speech produced by inexperienced signers during simultaneous communication," was published in the *Journal of Communication Disorders, 32*(2), 79-95. In this article, the authors describe the results of their research, which indicates that speech was significantly slower during simultaneous communication for students learning sign language, but that the temporal rules of spoken English were maintained. Additionally, as the students increased in their sign language skills, there were fewer and shorter spoken pauses and a closer approximation of simultaneity between speech and signs.

Ron Kelly and **Keith Mousley** (Department of Science and Mathematics at NTID) presented a research paper, "Deaf and hearing students' transfer and application of skill in math problem solving," at the 25th Annual Conference of the Association of College Educators for the Deaf and Hard of

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"In a comparison of adjunct questions, sign movies, and content movies in terms of immediate factual learning, both of the conditions that included adjunct questions yielded significantly greater factual learning, overall, than any of the other conditions."

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following the text. The Content Movie condition presented the instructional text followed by a corresponding content movie. The Sign Movie condition presented the instructional text followed by a corresponding sign movie. The Full condition presented all of the adjunct aids in sequence.

With three levels of reading ability, determined by the terciles calculated for the distribution of the reading comprehension scores, and five conditions, there were thus 15 between-subject cells in the design of this study. The criterion measure was comprised of scores from the post-test of immediate factual retention. The multiple-choice questions employed as adjunct questions were also used as the post-test questions. To prevent subjects in the Adjunct Question and Full conditions from simply learning which answer was correct for each question, both the sequence of the questions and their response alternatives were different for the adjunct question and post-test usages. With response-alternative positions thus varied, correct post-test responses would most likely reflect correct discrimination among the alternatives, and would not be influenced by the positions employed for adjunct question usage.

"Specific analyses of the reading level by condition interaction effect were performed to assess the significant components of this interaction. The Adjunct Question and Full conditions yielded significantly higher post-test scores for low reading level subjects than did either of the Text Only and Content Movie conditions."

Results

One of the most important findings in this study was that the Adjunct Question and Full conditions yielded significantly greater post-test performance than each of the Text Only, Content Movie, and Sign Movie conditions. Specific analyses of the reading level by condition interaction effect were performed to assess the significant components of this interaction. The Adjunct Question and Full conditions yielded significantly higher post-test scores for low reading level subjects than did either of the Text Only and Content Movie conditions. The mean for the Sign Movie condition was between these extremes and did not significantly differ from other conditions.

The overall pattern of the means for the middle reading level subjects was similar to that observed for the low reading level subjects, however, only as compared with the Sign Movie condition. That is, middle reading level subjects in the Full and Adjunct Question conditions performed significantly higher on the post-test than middle reading level subjects in the Sign Movie condition. Comparisons with the other conditions were non-significant. None of the conditions differed significantly for the high reading level subjects.

Comparisons were also performed between reading levels within each of the conditions. Those results indicated significant differences between reading levels for the Text Only, Content Movie, and Sign Movie conditions ($ps<.05$). No significant differences were found between reading levels for the Adjunct Question and Full conditions.

Also, comparisons were made across reading levels and conditions. Importantly, the low reading level subjects in the Adjunct Question and Full conditions performed on a par with the high reading level subjects in the Text Only condition.

Discussion and Implications

In a comparison of adjunct questions, sign movies, and content movies in terms of immediate factual learning, both of the conditions that included adjunct questions yielded significantly greater factual learning, overall, than any of the other conditions. Studies involving hearing subjects and a comparable study with postsecondary deaf subjects have demonstrated a similar direct learning effect from adjunct questions.

Learning performance for the Sign and Content Movie conditions did not differ significantly from the Text Only condition. This result was unexpected

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Hearing in Rochester, NY, February 26-March 1, 1999. Their research examined the ability of deaf and hearing college students to transfer and apply their math computation and problem-solving skills to similar problems presented under different conditions. The results showed that, while the problem solving performance of both hearing and deaf college participants was influenced by the increase in problem complexity and difficulty, the hearing college students performed consistently across both graphic and word conditions, while the deaf students' problem solving performance was not consistent. For more information, contact Kelly at e-mail *RRKNCP@RIT.EDU*

Members of the CRTL Research Strand on Student Retention and Success have developed and implemented

Harry Lang is a deaf professor at NTID. His research focuses on improving teaching and learning for deaf students, particularly in science and mathematics. He has authored more than 40 articles and three books, and has been the principal investigator in several National Science Foundation grants to train teachers and to investigate the role of technology in the lives of deaf people. He may be contacted at e-mail HGL9008@RIT.EDU

although consistent with findings from previous studies which indicate that concrete text, such as was employed in the present study, can mitigate the contribution of supportive pictorial aids. It is also consistent with Rothkopf's theory of mathemagenics, which asserts the crucialness of learner engagement with instructional materials. Despite the communicative and visual characteristics of the sign and content movies, they did not induce learner engagement, and this is probably why they did not result in greater factual learning than the text alone.

The implications of the present study pertain to both pedagogy and equitable access to instructional content. Adjunct aids in instructional prose that promote beneficial mathemagenic activities will more likely facilitate learning as compared to those that merely provide information. Any intervention or practice that can produce compensatory effects of the magnitude observed in this study has the potential for leveling the playing field for low-comprehension ability readers. Future investigations should focus on adjunct aids that hypothetically produce beneficial mathemagenic activities. The findings from such studies will provide valuable information for the design of multimedia instruction.

"Any intervention or practice that can produce compensatory effects of the magnitude observed in this study has the potential for leveling the playing field for low-comprehension ability readers."

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a research plan on how to question students regarding their satisfaction with academic and non-academic programming, college services, and personal skill growth. **Carol DeFilippo** reports that these results will be one of the outcomes of the U.S. Department of Education's key indicators for NTID. More than 500 surveys were distributed during Spring, 1999, requesting students to rate a variety of aspects of their campus experience. Students were also provided ample opportunity to comment on these experiences. Input and analysis of the responses are ongoing, and findings will be available in Fall, 1999. For more information, contact DeFilippo at e-mail *CDFNCP@RIT.EDU*

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A major focus of Sue Foster's work has been on the issues of access and accommodation of deaf persons in mainstream settings. She has published extensively on the topics of education and employment of deaf persons, including 'Deaf Students in Postsecondary Education' (1992, co-edited with G. Walter) and 'Working With Deaf People: Accessibility and Accommodation in the Workplace' (1992). For more information, contact Foster at SBFNIS@RIT.EDU

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Research for Teachers of Deaf Students: Practice and Challenges

by Susan Foster, Ronald R. Kelly, and Michael Stinson

Most graduate teacher education programs require at least one basic research course. At the National Technical Institute for the Deaf at the Rochester Institute of Technology, graduate students preparing to become certified teachers of the deaf in the Masters of Science in Secondary Education of Students Who are Deaf or Hard of Hearing program are required to complete such a course during their second year of study. *Foundations of Educational Research* is an introduction to research and inquiry in education. Students are introduced to the research process, including design, theoretical perspectives, review of the literature, methods of data collection, validity/reliability, data analysis, and interpretation of results. The primary purpose of this course is for the students to acquire research skills that they will be able to apply as classroom teachers to improve instruction and learning for students who are deaf or hard of hearing. Secondarily, this course is designed to provide graduate students with sufficient research and skills to enable them to complete their Master's project or thesis.

The majority of the graduate students enrolled in this research course have limited or no prior experience with research, and many enter it intimidated by the whole notion of research. Furthermore, most of them do not perceive any clear or practical relationship between research and their future roles as teachers of deaf or hard of hearing students. Realistically, they often perceive this required research course as an ordeal to get through in order to meet graduation requirements, rather than as an opportunity to learn valuable research and analytical tools that they can utilize as teachers.

The team of faculty involved in teaching the *Foundations of Educational Research* course is increasingly trying to demonstrate to students the importance of applied research to the teaching process. Recently, at the 25th Annual Conference of the Association of College Educators for the Deaf and Hard of Hearing in Rochester, New York, three NTID faculty who teach this course conducted an Interactive Demonstration on "Research for teachers of deaf students: Issues, practice and challenges" (Foster, Kelly, & Stinson, 1999). The primary goal of this Interactive Demonstration was to initiate discussion from participating college educators on how to make research more relevant to graduate students in teacher education. In addition, this discussion was intended to elicit ideas and suggestions from participants on how to better demonstrate and emphasize the application of research knowledge and skills to the teaching and learning process. The basis for this Interactive Demonstration was a draft matrix matching seven potential roles of teachers to the research knowledge and skills currently covered in the *Foundations of Educational Research* course.

The learning activities for this research course involve a number of hands-on activities. For the literature review component, the students familiarize themselves with electronic search tools, conduct a literature review on an educational topic of their choice, and identify findings that have practical application to teaching and learning. With regard to the research design component, they are presented with a number of examples of quantitative and qualitative designs and given opportunities to code sample data for each. The activities for statistical analysis, data interpretation, and organizing and explaining information also involve working with samples from a variety of applied

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All graduates of NTID/RIT will be receiving a survey questionnaire regarding their satisfaction with the educational experience here and their work experiences. This is the first full-scale survey of graduates since 1996. It is a joint effort between the Research Department (**Ron Kelly**, **Janet MacLeod-Gallinger**, **Bob Whitehead** and **Jerry Walter**) and the Development Office of NTID. In addition, the expertise of the Marketing Communications Department will be provided to help design the final form of the survey materials. Reports of the results of the survey will be provided by Winter, 2000. For more information, contact Kelly at e-mail *RRKNCP@RIT.EDU*

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

Ron Kelly's research interests include problem solving, comprehension, cognitive processing, and technology applications for deaf and hard-of-hearing students. He also teaches Foundations of Educational Research, and Psychology and Sociology of Adolescence, in the Master of Science in Secondary Education of Students Who Are Deaf or Hard-of-Hearing program at NTID. For more information, Kelly can be contacted at RRKNCP@RIT.EDU

Michael Stinson is a professor in the Department of Research at NTID.

educational research studies. At the end of the course, students individually organize and present the results of their literature review on a topic of their choice. Generally, students use this course assignment to review the literature for what might become their Master's project. In addition, the course content includes discussions on cultural and political issues in research, and ethical issues related to research.

The authors of this article are continually striving to improve the research experiences of students pursuing their graduate studies to become certified teachers of the deaf and hard of hearing. Readers of this article who have ideas about teachers' roles that involve the need for research knowledge or skills are encouraged to share their perspectives. Please send comments and suggestions to Ron Kelly at the address listed on the *NTID Research Bulletin*. Or you may e-mail your comments and suggestions to Ron Kelly at *RRKNCP@RIT.EDU*

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Relevance of research knowledge and skills for teachers

Teacher roles → / ↓ Research knowledge and skills	Read and evaluate literature	Maintain currency on issues and research in field	Assess student outcomes	Improve instruction through action research	Apply research from literature to practice	Communicate information	Collaborate with researchers
Develop the skills to review, analyze, and understand research literature	X	X		X	X		X
Understand the appropriate application and rationale for the different research designs	X		X	X			X
Understand how to code and organize qualitative and quantitative data			X	X	X		X
Understand how to interpret data and organize and explain the information clearly			X	X	X	X	X
Understand the application and rationale for the different statistical tests	X		X	X		X	X
Understand ethics in research	X		X	X	X		X
Understand cultural and political issues in research	X			X	X		

Susan Fischer gave a colloquium at the SUNY Buffalo Linguistics Department on March 26, 1999. Her topic was a comparison of WH-constructions (sentences containing the question words *who, what, which*, etc.) in ASL and NS (the sign language of Japan). For more information, contact Fischer at e-mail *SDFNCR@RIT.EDU*

Michael Stinson's article, "Considerations in educating deaf and hard of hearing students in inclusive settings," co-authored with Shirin Antia (University of Arizona) will be the lead paper in a *Journal of Deaf Studies and Deaf Education* special topic issue on inclusion and education of deaf students. The issue is co-edited by Antia and Stinson.

IMPLICATIONS OF NTID RESEARCH

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

Vol.4 No.2 Spring 1999

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.

Stinson, M.S., & Stuckless, E.R. (1998). Recent developments in speech-to-print transcription systems for deaf students. In A. Weisel (Ed.), *Issues unresolved: New perspectives on language and deaf education*. Washington, DC: Gallaudet University Press.

Deaf students in mainstream settings face many difficulties in understanding the teacher and in participating in class discussions and activities. Because printed information is especially valuable to many deaf students, real time speech to print transcription systems are helpful for communication access. These systems transcribe the speech into print at the same time the words are being spoken; a hearing transcriber keys in either a verbatim or condensed version of what the speaker is saying. This paper describes recent progress with two systems: a steno-based system, and the "C-Print" system under development at NTID.

Implications:

The C-Print system provides a quality option that many students consider as good or better than the current services of interpreting and notetaking. Providing the C-Print system, along with other support services, should enable school programs to meet demands for services in a cost-effective and successful fashion. The technology is inexpensive, there appear to be many potential operators, and the operators can be trained to provide quality service in a short time. The system is particularly timely, as more deaf and hard-of-hearing students are being enrolled in local schools and require support services, even as funds for special education services are declining.

Caccamise, F., & Lang, H. (1996). *SIGNS for science and mathematics: A resource book for teachers and students*. Rochester, NY: Rochester Institute of Technology, National Technical Institute for the Deaf.

Skilled signers knowledgeable about science and mathematics were interviewed in order to collect signs that they use for science and mathematics terminology. These signs, together with previously published signs, were then shared with other science and mathematics experts who provided judgments of the acceptability and non-acceptability of these signs. Based on the results of this process and respondents' sociolinguistic background, signs were selected for inclusion in this publication, which also includes a selected reading list on science and

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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 information are welcome.

mathematics education for students who are deaf, and a feedback form for readers.

Implications:

Artificial versus natural sign language vocabulary development continues to be a major issue in academic settings. The results of the process used to document and select signs for inclusion in this publication, like similar NTID sign language publications, demonstrate that effective communication in academic environments can be supported through a systematic process for observing, documenting, and sharing what skilled signers do. Such efforts take advantage of the natural mechanisms in all languages, be they spoken or signed, for developing the vocabulary needed by language users.

Samar, V.J., Parasnis, I., & Berent, G.P. (1998). Learning disabilities, attention deficit disorders, and deafness. In M. Marschark and M.D. Clark (Eds.), *Psychological perspectives on deafness*, vol. 2 (pp. 199-242). Mahwah, NJ: Lawrence Erlbaum.

The literature on learning disabilities (LD) and attention deficit disorders (ADD) in the deaf population is reviewed within the broader context of mainstream research on LD and ADD. Problems of definition, evaluation, and syndrome complexity that hamper progress in understanding the nature of LD and ADD in the deaf population are discussed, and some promising new directions for research on evaluation and remediation of LD and ADD are identified.

Implications:

LD and ADD are the largest categories of additional disabilities among deaf children. Teachers often note that schools seriously underserve deaf children with LD and ADD and that finding effective ways to identify and accommodate the learning needs of these children is an urgent priority. While progress has occurred in understanding, identifying, and remediating LD and ADD in hearing children, very little specific research on these issues exists for deaf children. This chapter discusses the small literature on deaf people with LD and ADD, and suggests new evaluation and research approaches based on the more advanced literature on hearing people.

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.

___ *Stinson and Stuckless. Recent developments in speech-to-print transcription systems for deaf students.*

___ *Caccamise and Lang. SIGNS for science and mathematics: A resource book for teachers and students. Available for $25 from Campus Connections, Rochester Institute of Technology, 48 Lomb Memorial Drive, Rochester, NY 14623-5603.*

___ *Samar, Parasnis & Berent. Learning disabilities, attention deficit disorders, and deafness.*

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Two of the adjunct aids to reading comprehension investigated by the Dowaliby-Lang study, sign movie and adjunct question, are displayed in the screen captures shown at right. See the article on page 1 for a discussion of this research.