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ABSTRACT

Students who are deaf often have great difficulty in accessing written English. A "bilingual" approach to education may help deaf students improve their literacy skills. This paper explains work in progress regarding two projects supported by the United States Department of Education, which explore the potential of interactive video technology and sign language for improving reading comprehension and test-taking skills of deaf junior high and senior high school students. These projects feature: student access to one or more signed versions of English to help them understand any portion of the target text; a sign language dictionary of difficult words or phrases; and instruction, questions, and corrective feedback provided in sign language as well as text. Use of the multimedia technology and sign language appear highly motivational to students. A number of factors seem to influence students' capacity to benefit from sign language helps: sign language comprehension skills of students; level of prior language-related reasoning experience; prior knowledge of the topics; knowledge of the operation of the computer system; and beliefs about the usefulness or appropriateness of sign language. (Contains 12 references.) (Author/MAS)

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## Interactive Video and Sign Language for Improving Literacy Skills of Deaf Students

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**Abstract:** Students who are deaf often have great difficulty in accessing written English. A "bilingual" approach to education may help deaf students improve their literacy skills. This paper explains work in progress regarding two projects supported by the United States Department of Education, which explore the potential of interactive video technology and sign language for improving reading comprehension and test-taking skills of deaf junior high and high school students. These projects feature: student access to one or more signed versions of English to help them understand any portion of the target text; a sign language dictionary of difficult words or phrases; instruction, questions, and corrective feedback provided in sign language as well as text. Use of the multimedia technology and sign language appear highly motivational to students. A number of factors seem to influence students' capacity to benefit from sign language helps.

### PROBLEM

Despite dedication on the part of educators during the more than 150 years since educational programs for the deaf were established in this country, most deaf individuals are far behind their hearing peers in the acquisition of literacy and knowledge (COED, 1988; Moores, 1987; Moores & Sweet, 1990; Marschark, 1993). Research shows that average 18- to 19-year-old, severely to profoundly deaf students are reading no better than the average 9- to 10-year-old hearing students (Paul & Quigley, 1990). This fact is often a great surprise to those not acquainted with deafness; it is commonly assumed that individuals who are deaf should have no special difficulty in understanding written English, unless they are also visually impaired. Nevertheless, this lag is a harsh reality and presents a great barrier to academic and employment opportunities for deaf individuals.

Researchers have considered various explanations for the cause and nature of the difficulties that deaf readers encounter with English text. It has been diversely suggested that the focus of the problem lies in semantics or syntax, or in sentential level comprehension, or in discourse level interpretations of text (Moores, 1987; Paul & Quigley, 1990). Findings remain inconclusive at best, although it is safe to say that the problems and solutions are complex. At the heart of the matter is the reality that most deaf children begin school insufficiently grounded in rich early language and learning experiences (Martin, 1985) and are further set back during the school years by insufficient access to the language and culture of the educational system (Vernon & Andrews, 1990).

Thus, in summary, English most often is not fully accessible to deaf students as a first and/or primary language. Consequently, deaf students generally experience extreme challenges in mastering English literacy. These inadequate literacy skills contribute to poor performance on standardized tests and often limit opportunities for postsecondary education and for employment.

### Possible Solutions

Fortunately, there may be solutions or partial solutions on the horizon. Among them are: (1) educational tools that utilize deaf students' competencies in sign language that may help build English skills; (2) advances in interactive video and computer technologies that provide new possibilities for teaching and

learning; (3) bilingual-bicultural approaches that may allow the development of new techniques to enhance language-related thinking.

For those individuals who sign, it seems that access to sign via interactive videodisc technology might facilitate understanding of reading comprehension tasks, such as those which appear on standardized tests. Despite research that has examined the issue of sign comprehension by deaf persons of various backgrounds (Caccamise & Gustason, 1979; Caccamise, Hatfield & Brewer, 1979; Quigley & Paul, 1984; Johnson, Liddell & Erting, 1989; Bochner & Albertini, 1988), the data remain inconclusive. An important issue warranting further investigation concerns which kinds of signing to use in specific learning contexts.

## PURPOSE

Under support from the U.S. Department of Education, Educational Testing Service is carrying out two projects that explore the use of interactive video technology and sign language as "levers" for improving the learning, performance, and diagnostic assessment of deaf individuals. It is hoped that these projects will help define, as well as improve, the kinds of accommodations that can and should be provided to deaf individuals in academic and professional testing and certification situations. The major research goals of the projects are as follows:

1. Explore the use of sign language and interactive video for improving English literacy and test-taking skills.
2. Observe how student characteristics, environmental influences (e.g., school language policy), and content variables (e.g., type of passage) may relate to students' preference for ASL or English-based sign (a version that adheres more closely to English word order).
3. Observe how each signed version assists comprehension.
4. Explore bilingual-bicultural approaches for enhancing language-related reasoning and the literacy that builds upon it.
5. Lay the groundwork for improved tools for instruction, assessment, and performance support.

## Background

Prior to the two current projects, some of the concepts of the project were tried in a demonstration system in 1991. This proof-of-concept system uses sign language and interactive video. The main display of the application shows three "windows" -- one for scrollable passage text, one for the questions, and another for either of two sign language versions to be displayed in motion video. A variety of controls are available, mostly at the bottom of the screen, and are activated by mouse. In order to see a signed version of some English text, the student selects a portion of English text on the computer using the mouse and then selects either of two signed versions -- American Sign Language (ASL) or English-based sign. The system then displays a video of a person signing the material.

## METHOD

The two new projects supported by the U.S. Department of Education build on the 1991 Demonstration System. These projects are aimed at deaf readers who are fairly proficient.

## Hardware and Software

The system for both projects is based on a Macintosh platform. The system uses a Macintosh II-family computer, with a video graphics overlay card that allows full-motion color video from a Pioneer laserdisc player. The video is displayed in a resizable window on the computer screen. We are using the RasterOps 24STV video graphics overlay board and a Pioneer LDV-4200 laserdisc player. This and several other Pioneer player models allow one to jump to and begin playback of any section of the video in less than one second, making it easy to display any signed passage on demand. We are also using Quicktime movies for

selected portions of the system and may store that compressed video on CD-ROM. The application software is being developed using the SuperCard (Allegiant Corporation) authoring software.

## The Projects

### Project 1: Test Preparation

Project 1, "Sign Language and Videodisc for Test Preparation Materials for Deaf Secondary School Students" (Grant No. H133C20006-92), focuses on the issue of test preparation. The audience for this one-year project is deaf high school students. The project is intended to demonstrate the feasibility of using ASL and video technology to help students prepare for standardized tests, especially tests of reading comprehension. The system provides a total of about 30-45 minutes of interactive instruction plus an online sign language dictionary. Small-scale pilot testing was carried out in the fall of 1993.

### Project 2: Tools and Techniques for Improving Literacy

Project 2, "Videodisc Technology and Sign Language for Improving Reading Skills of Deaf Middle School Students" (Grant No. H180G20021), focuses on a variety of issues related to the improvement of literacy skills in deaf students. This three-year project focuses on middle school students. This project has two major phases.

1. Phase 1. Phase 1, to be completed in the mid-1994, entails an experiment to learn more about (a) factors that affect the impact of sign language helps (i.e., accessible sign language versions) on student performance and (b) indications of student preference for the particular signed versions -- ASL and an English-based sign. Each subject performs two tasks. For each task the subject reads a reading comprehension passage and then, using sign language, retells the passage to a deaf signer. For one of the two tasks, the subject then re-reads the passage as necessary and answers four or five multiple choice questions without any access to sign language helps. For the other task, the subject rereads and answers the multiple-choice questions with full access to both ASL and English-based sign versions of both the passage and the question. Thus, each student sees two reading sets (passages plus questions), one with no access to sign language and the other with access to both signed versions, thereby allowing us to estimate the performance benefit that might result from such access. In order to balance out possible order effects such as fatigue and practice, the experimental design is balanced for both (1) order of conditions and (b) order of sets. It is expected that 24-48 subjects will be involved in the experiment. This experiment is in progress currently and is expected to be completed by early summer 1994.
2. Phase 2. Phase 2 of Project 2 explores techniques and approaches for bilingual and bicultural education. This phase will build on the current systems but will also include: (a) student video-production projects utilizing acting, signing, and writing; (b) computer exercises in reading; and (c) an enhanced online dictionary.

## The Challenge of Translation/Production

One of the most significant challenges of the projects is the process of translation/production. The terms "translation" and "production" are joined because we find that much of the translation and production need to occur together in the same sessions. The process of translating English text to ASL and English-based sign usually requires a team of several people, who represent expertise in the following areas:

- Linguistic knowledge of both ASL and English.
- Native or near-native ASL competence
- Native or near-native English competence
- Acting skill and experience
- Video production with deaf actors
- Management and coordination

Although the actor and director can "draft" the translations prior to video recording, the translation cannot be readily or fully transcribed – rather the "practice shots" or "drafts" must be videotaped and critiqued. What seems to work well is for the director and actor to review the English source material independently, and then come together to negotiate the subtleties of an acceptable signed rendition of the material. We find that the camera person must be ready to capture the translation. Sometimes a "first draft" or "practice shot" turns out to be "perfect," so it is critical to be ready to record.

## PRELIMINARY RESULTS

Although we are currently in the process of gathering data, we have made some tentative observations.

- The Motivational Impact of Interactive Video. Students expressed enthusiasm about working with computers, especially interactive video.
- The Motivational Impact of Sign Language. Students appreciate seeing examples of excellent signing. Most are children of hearing parents who do not have excellent signing skills. Most of their teachers are hearing and have only moderately good skills. To see educational content signed by deaf signers with excellent signing skills is highly motivating.
- Factors That May Affect the Benefit of Sign Language Helps. Preliminary impressions of student use of the technology suggest that there are a variety of skills and factors that may influence the amount of benefit to be initially derived from sign language helps. Some of these factors are as follows:
  1. Sign Language Comprehension Skills of Students. Students appear to vary widely in their receptive skills in ASL and English-based sign; these skills would have a major impact on their ability to benefit from the sign language helps.
  2. Level of Prior Language-Related Reasoning Experience. While the incidence of specific language disabilities may not be higher in the deaf population than in an otherwise comparable group of hearing students, deaf students – most of whom have hearing parents – may have had less experience in language-related reasoning and hence may perform less well on language-related tasks, even when sign language helps are available. (For this reason, the project plans to include assessment of students' sign communication proficiency and comprehension of passages presented in sign language.)
  3. Prior Knowledge of the Topics. Students who are unfamiliar with the content in the reading comprehension passages may be unfamiliar not only with the English words and phrases but also their sign language equivalents or analogs.
  4. Knowledge of the Operation of the Computer System. The usefulness of the sign language helps is obviously dependent on students' understanding of the operation of the computer system. Most students seem to have little if any problem with the operation of the system. However, early in the field testing it became apparent that at least one student did not make use of sign language versions of questions because she did not realize that help was available for questions just as it was for passages (although an online tutorial attempted to make that point clear). Subsequently, the deaf research team member who administered the field test stayed with the student for the start of this task to be sure that it was clear that such help was available.
  5. Beliefs About the Usefulness or Appropriateness of Sign Language. The usefulness of sign language helps can be influenced by the student's beliefs about the usefulness or



appropriateness of sign language for particular purposes. For example, one student simply did not use the sign language helps at all because she did not believe that it was appropriate to use sign language in the context of a reading comprehension task. Furthermore, some students may have persistent preconceptions about the relative value of a particular version of sign language over another; this was one reason that we chose not to designate the two versions by the terms "ASL" and "English-based sign." We did not wish to have the results influenced by students' prior beliefs about various forms of signed communication.

## CONCLUSIONS

The current projects appear to confirm the highly motivational impact of multimedia and of sign language materials for deaf students. The current stage of the research effort does not permit solid conclusions about other benefits of sign language helps on instruction, performance support, and assessment. However, it appears that a number of challenging factors must be addressed in any system designed to leverage students' sign language ability in order to improve their English literary skills. Through continued research, we hope to learn how to address those challenges so that some variation on this approach can become a high-yield application of multimedia and other computer technologies.

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