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ABSTRACT

This report outlines the a study that investigated the reading skills of high school students (ages 14-19) with severe or profound prelingual deafness, including 6 skilled readers with parents with deafness, 6 skilled readers with hearing parents, and 6 average readers with hearing parents. The study determined short-term memory strategies used by individuals with deafness in contrived and real-work reading situations, and explored the correlation of these strategies with: (1) individual factors such as reading level, level of hearing loss, and age of onset; (2) educational and family characteristics, including communication mode and language, parent adaptation, involvement, permissiveness and expectations, and early reading, sign, and speech experiences. (CR)

THE DEVELOPMENT AND USE OF CHEREMIC, GRAPHEMIC, AND PHONOLOGICAL CODING IN DEAF HIGH SCHOOL-AGED READERS

BY

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FINAL PERFORMANCE REPORT
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Introduction

This was an OSERS-sponsored study of the reading skills of deaf high school students. The average reading level for a deaf eighteen-year-old is a little under fourth grade. However, some deaf individuals are excellent readers. This study sought to answer the question of why this is so. There have been few studies examining the strategies that deaf readers use to code print in short term memory (STM), and almost none that examine skilled deaf readers as compared to average, poor readers, especially comparing subjects in deaf families and hearing families. Furthermore, there is no study comparing both groups to a control group of hearing students.

We began this investigation by looking at two types of data, quantitative and qualitative, in an effort to triangulate data and increase our understanding. The quantitative data collection focused on a investigator-devised experiment designed to tease out the strategies students were using to code print. Other quantitative measures included standardized reading and English language tests, informal speech, speechreading, and American Sign Language (ASL) evaluations. Qualitative measures included videotaped or audiotaped interviews with the students and their parents, gathering data on personal, family and educational characteristics. Subjects were seen in their homes for one four hour period from April 1996 to February of 1998.

This final performance report will focus on the following areas: subject recruitment, development of quantitative and qualitative

materials, piloting, other changes, additional questions that arose, and findings. Within each area, several questions will be posed and answered: What was proposed in the original grant? What, if any, obstacles were encountered? What adaptations were made to address these obstacles? Please refer to the original grant "Deaf Adolescents' Coding Strategies in Reading English Print" (running head: Coding Strategies in Deaf Readers) for more detail regarding this research.

Subjects

What Was Proposed?

The proposal specified 20 severely or profoundly (unaided results) prelingually deaf high school students aged 14-19. Subjects would be recruited through schools and programs in the northeast. One or both of their parents would also be interviewed. Half would be skilled readers (≥9th grade) and half average readers (3rd to 5th grade), and half would have deaf parents and half hearing parents, creating four groups of five students each. We also planned to include another group of 20 hearing high school students, all with a reading level of 6th to 7th grade as controls. Students were to be from homes that did not use any languages other than English or American Sign Language (ASL).

What Obstacles Were Encountered and What Changes Were Made?

Locating Subjects

Despite almost two years of running advertisements, contacting almost every school and program in New England (as well as many in the northeast) that has deaf high school students who communicate primarily through signed language, and tapping into a network of colleagues and personal friends, it proved nearly impossible to assemble one of the four sub-groups: the average-reading deaf students with deaf parents.

Deafness is a low-incidence population to begin with (0.1%), and only 5 to 7% of those go on to have deaf children. Therefore, very few students have deaf parents. Those who do were either excellent readers or (we were repeatedly told) they had other disabling conditions (most frequently learning disabilities), which would preclude their participation. As a teacher of deaf students for twelve years, the student investigator knows these students exist, but in such low numbers that we were not able to recruit any. Consequently, we dropped this group from the study.

Therefore, instead of four groups of five, we recruited three groups of six subjects each: (1) skilled readers with deaf parents, (2) skilled readers with hearing parents, and (3) average readers with hearing parents. The number of control subjects was changed to 18 as well.

Reading Categories Broadened

In addition, the proposed reading levels for the deaf students (≥9th and between 3rd and 5th) were found to be too exclusionary. Therefore, students with reading levels of 6.0 and above were categorized as skilled readers and students with reading levels between 2.5 and 5.0 were classified as average readers.

Hearing Levels Lowered

The proposed cut-off for hearing loss was 70dB or greater, but one student had more hearing than that (63dB). As he is from a deaf family, attends a deaf residential school, and does not wear amplification, it was decided to include his data. This 70 dB cut-off was arbitrary, as some deaf individuals with a greater hearing loss who wear hearing aids are very oral in their thinking and communication (and perhaps their approach to reading), while others with much more hearing but who do not wear

hearing aids are very manual in their communication (and again, perhaps in their reading).

Home Languages

Two students whose parents spoke English plus another language, one Spanish and the other an Asian language, were included in this study. These parents volunteered in the initial telephone contact that they only spoke English with their deaf children, especially after they discovered their child's deafness and started to use sign language with them. One student had had speech therapy in Spanish in his country of origin, but his formal education began here at age six, and the entirety of the other student's schooling in her native country was in English until she moved here at age eleven. Both families moved for the educational opportunities available here for their deaf child. Unfortunately, both of these students were in the average reader group, which may be a confounding factor in the results. It should be added that the examiner did not observe languages other than English being spoken in these two homes. The test results do not appear to be different for these two students when compared to other members of their subgroup.

Controls' Reading Levels Raised

In addition, it was difficult to locate hearing control students with a reading level below 6th grade who did not have some kind of learning disability to preclude their reading at or near grade level. Control subjects were therefore included with any reading level at or over sixth grade. The average reading level for the control group was 10.222+ compared to 10.675+ for both groups of skilled deaf readers. Both groups had students who scored at a post high school (PHS) level (27.778% hearing controls and

33.333% for the skilled deaf readers), so the actual averages are higher than those shown.

Materials

What Was Proposed?

The proposal included both quantitative evaluations and qualitative evaluations.

A. Quantitative Materials

The proposed quantitative evaluations for all subjects were: a researcher-designed two-part short-term memory (STM) task and the reading subtest of the Stanford Diagnostic Reading Test, 3rd Edition For the deaf subjects only, an informal measure of speech intelligibility (both auditory and visual), and a speechreading test were also planned.

Short Term Memory Test

The computerized Short Term Memory (STM) test was designed to measure errors of three types: sign-based (translation) errors, word-shape (visual) errors, and sound-based (phonological) errors. If a subject made more errors on a given type of word list or sentence than on a control list, s/he is presumed to be utilizing that type of strategy to encode or remember words and sentences. This confusion and resulting errors indicate usage of a specific strategy: an example would be, for hearing people, that a word list such as {shoe do two blue new} is harder to remember than a word list that does not rhyme. For deaf people, who may translate such word lists into signs, however, it was proposed that they would be confused by "look-alike" signs, signs which were done with the same handshapes or movements. Stimuli included 18 lists of six words and 20 sentences.

What Obstacles Were Encountered and What Changes Were Made?

STM Word Subtest

The number of words on each list on the STM test was lowered from 6 to 5 words after piloting the STM test on several hearing and deaf adults who struggled mightily. One word from each group was then randomly removed, with the exception of three words that had no direct sign equivalent: ZOO, TOE, and FLEA. These three words were the ones removed from their respective lists, leaving only words with one commonly accepted sign translation on all word lists.

Vocabulary Lists

Vocabulary lists of all words used in the STM test were shown to both control and experimental subjects and they were asked to read the list aloud. They were also asked, "Do you know these words?" All control students knew all of the words, as evaluated by reading them aloud accurately and by verifying that they knew them. The deaf skilled readers knew all or all but one word of the 94, for a group average of 99.823%. The one word that was misread by two different students was *through* rather than the printed *though*. The average for the average deaf readers was 93.794%, with a range of 82.979% to 100%. Initially, it was planned that results of subtests using unknown words on the STM test would be omitted for that student. However, because the STM test also demands that the same words be recognized, stored, and written in both the control and experimental conditions, it was decided that there would be no reason to do this.

Speech Samples

Requests for speech samples from the subjects were generally met with sighs and a great rolling of eyes. Almost all students exhibited

discomfort with this section, either saying "I hate speech" or "Speech is not connected with intelligence," or shifting and showing through body language their discomfort. The examiner would cajole, saying (truthfully), "Well, that's exactly what I want to prove, that deaf people can be good readers even if their speech is not intelligible." All but three students eventually capitulated; the three holdouts all have deaf parents, attend the same residential program, had not been required to voice in middle school or high school classes, and all felt strongly that deaf rights included not having to use their voices.

Speechreadability

Speechreadability measures, or evaluations of the clarity with which the student mouthed sentences, were confounded by the efforts many students had to make to create clear sounds for the tape-recorder. This led to an inability to make this evaluation and thus a visual measure of speech intelligibility was dropped. It is the student investigator's experience that "silent" reading with no voicing can sometimes be very clearly lip-read by an observer, but not with voices added.

What Other Changes Were Made to the Quantitative Data Collection?

TOLD-I Added

Upon the request of a committee member from Kansas, the Test of Language Development-Intermediate (TOLD-I) was added as a measure of English ability. An advantage to this test was that subtests may be selected to quantify semantic and syntactic abilities, but a disadvantage was that the highest norms only reach age 12. Another disadvantage was that the test was given through-the-air with a great deal of fingerspelling ("franc, peso, yen...how are they the same?"), and some students may not have understood the examiner's fingerspelling or signing well enough.

Speech Quality Rating Evaluators and Range

For the speech quality ratings of students' paragraph reading, a third evaluator was added to the proposed two. All three were not only "familiar with the speech of deaf persons," as initially proposed, but were certified teachers of deaf students and had at least five years of teaching experience. They ranked the oral skills of the students on a ten-point scale, rather than the proposed five-point scale.

Speechreading Test

Instead of using the Haskins Kindergarten PB word list to measure speechreading skills, a dissertation committee member suggested using the Craig Lipreading (sic) Inventory/Word Recognition Test, administered in the no-voice condition. Subjects had to watch the student investigator mouthe one of four picture stimuli and point to the one said. The final score is a percentage correct of 33.

Recalcitrant Equipment

The student investigator wrestled with machinery several times. One deaf student's STM test results were not saved properly and were lost when turning on the laptop at the airport security gate. This student was retested 7 months later when the student investigator returned to her town. When questioned, she said she did not remember the words from the first test or why they were grouped in certain ways. However, she did do better on the sentence portion of the second test than the first (eleven errors to a later six), but one large group of errors in the first round of testing was forgetting to write a whole phrase; without that phrase, the sentence scores would have been nearly the same. It is not possible to reconstruct the word-level scores as each STM test presentation re-shuffles the lists and the words within the lists.

The other episode was a three-time computer restart and repeat due to freezing up of the laptop. This hearing subject went on to have, the final time, a perfect score on the entire STM test. Given that he also scored post high school (PHS), with only two wrong on the SDRT reading evaluation, a perfect score on the STM test is not impossible (several other students, deaf and hearing, had only a few wrong).

B. Qualitative Materials

What Was Proposed?

The qualitative portion of the proposal included a semi-structured subject interview, and a questionnaire and interview with each experimental subject's parent(s). The interviews were to be videotaped within a week of the STM test. The subject interviews focused on two areas: (1) to ask students to report and reflect on their own coding strategies in the STM test and other word-play and (2) to elicit such strategies in real-life kinds of situations via role-play, e.g. recalling a name, phone number, or quotation. The parent interviews focused on the family and early reading experiences.

What Obstacles Were Encountered and What Changes Were Made?

Parent Interviews

All hearing parents and 5 out of 6 deaf parents agreed to be taped, either on audio cassettes or video. One deaf mother flatly refused to be videotaped, and extensive notes were taken instead. In addition, a few of the questions asked during the parent interview changed as time went on. The questions about reading to the very young child was changed to ask about favorite books at that time. If a parent could name a favorite book or two, then it was assumed that they did do read-alouds with them, but even this did not work very well, as the favorite books changed over time.

Cantankerous Machinery, round two

An oral interview with a hearing mother was done in which the second side of the tape recorded but not the first. Answers were reconstructed from memory the next day when the tape was checked.

Piloting

Two Meetings Became One Longer Meeting

The lag time of one week between two visits was found to be far too long; in fact, subjects had a difficult time remembering what strategies they had been observed using five minutes prior. We collapsed the two-part testing into one day and moved the videotaped interview immediately after the STM test, with strategy questions first rather than last. Parent interviews were done while the subject took the SDRT, a paper-and-pencil timed test. One visit was also easier on the examiner because of the distances traveled (twice to Washington, D.C./MD and once to NJ as well as around Massachusetts and NH).

Role-Plays

The role-plays were also changed a bit. There was only one task in all of the testing involving numbers, so the subtask of remembering a phone number was eliminated.

Random Order

Although the proposal called for the tests to be given in a specific order, it seemed better, after the pilot, that subtests be given in random order, due to possible subject fatigue. The exception was that the STM test was immediately followed by the videotaped interview to immediately discuss observed strategies. To randomize the tests, the examiner offered a choice between two evaluations ("We have to do a test where you talk into a tape recorder and another test where I will ask you some

vocabulary questions in sign and you will sign your answers back. Which do you want first?)

Additional Questions

Evaluation of ASL Skills

We were very pleased to find a very skilled ASL transcriber who is a well-educated professional and who is also a deaf adult from a deaf family. We had originally thought we could use a deaf college student, but were unhappy with the English skills of several (paid) trial transcriptions.

We realized we had a number of measures of English skills but no measure of signing or ASL skills of either the parents or the students. We wondered if ASL skills, in either the parents or students, would be correlated with any of the other measures. Several evaluations of ASL skills were added to the battery. First, the ASL transcriber gave a ranking of skills on a 1-10 scale. Secondly, all subjects and parents were asked to sign a two-sentence measure developed by James Woodward of Gallaudet University to assist in placing signers on a continuum of ASL to English, and the results would be analyzed using his method. It was found that James Woodward's sentence analysis (with a scale of 0-4) did not show the variability of the transcriber's judgment, so a third way (a scale of 0-13) of analyzing the sentences was developed by the student investigator and compared.

Other Changes

Signing Students and Parents Required

Deaf students who did not sign or students who did, but who did not have a parent who signed (however well) were interested in participating in this study (as shown in responses from advertisements), but due to the nature of the testing, only signing students with one or more signing

parent could be included. This was not specified in the proposal or the letters to the schools, as the student investigator mistakenly thought that any student with this significant a hearing loss would be rather likely to sign.

Project Director's Meeting

Although the grant specified that there was mandatory attendance at a Project Director's meeting in Washington, D.C., neither the P.I. or the student investigator received notification regarding such a meeting. The budgeted amount was used for cost overruns on other travel, communication, and postage.

Findings

What was Proposed?

There were two major research questions. First: What coding strategies do deaf readers utilize, and how is the strategy correlated with reading achievement? How can we assess the type of coding used? Secondly: What kinds of individual, family, and educational factors correlate with these coding strategies?

What Was Added?

In addition to the already proposed questions, a number of other and more specific questions have arisen upon doing the research and seeing preliminary data. These include:

- What effect, if any, does parent or subject skill in the use of ASL have on coding strategy or reading skill?
- Which measure of ASL skills is most useful?
- Is there a correlation between ASL and English skills?
- Is there a correlation between skills in English (as measured by the TOLD) and reading skills (as measured by the SDRT)?

- Does the amount of parent involvement translate to skilled reading?
- What effect does early intervention in the form of early speech therapy, sign exposure, or aided hearing have on the later reading and language achievement scores?
- On the sign-based subsections of the STM test, does handshape, movement, or location show greater confusion at the word level? Similarly, if two parameters of a given set of signs are the same, is that more or less confusing?
- Are there any subsections of the STM test that easily and by themselves could indicate strategies used?

What Has Been Accomplished Thus Far?

A preliminary analysis of the data has been completed. Further analysis is in progress for a Spring 1999 dissertation. A copy of the dissertation will be sent to OSERS, attention of Mary Vest. Please let us know if an archive exists to which we should forward papers or other works based on this research. As always, all writing or presentations using this material will gratefully acknowledge OSERS support, and will include the usual disclaimer that this research does not necessarily reflect the views of OSERS.

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