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A Comparative Investigation of the Differential Effects of American Sign Language and Total Communication on Story Comprehension and Memory in Deaf Children

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LOYOLA UNIVERSITY

A COMPARATIVE INVESTIGATION OF THE
DIFFERENTIAL EFFECTS OF AMERICAN SIGN LANGUAGE
AND TOTAL COMMUNICATION ON STORY COMPREHENSION
AND MEMORY IN DEAF CHILDREN

A DISSERTATION SUBMITTED TO THE FACULTY
OF THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

DEPARTMENT OF COUNSELING AND
EDUCATIONAL PSYCHOLOGY

BY

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CHICAGO, ILLINOIS

MAY, 1992

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VITA

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CHAPTER I

INTRODUCTION

Numerous studies have documented the fact that deaf children perform well below hearing children in nearly all areas of academic achievement (e.g., Reamer, 1921; Pugh, 1946; Myklebust, 1964; Gentile, 1972). Allen (1986) reported that the average deaf high school graduate reads at only the third to fourth grade level, and that the gap between the deaf and their hearing counterparts widens with every year in school. Similarly, a number of negative conclusions were reported by the Commission on Education of the Deaf, which convened in 1987 to examine the status of deaf education in the United States. Throughout the report (cited in Johnson, Liddell, & Erting, 1989), the Commission reiterates its conclusion that the results of current methods of deaf education have failed to live up to original expectations. While the serious impact of prelingual hearing loss is readily acknowledged, many in the field insist a better job can be done. A growing number of critics have charged that system failure has occurred largely because school programs are not presenting curricular material in a linguistic form which is truly accessible to most deaf children (Johnson et al., 1989).

History of Methods Controversy

Methods controversy is nothing new in the field of deaf education. The conflict between proponents of the oral method (where the focus is given to auditory, speech, and lipreading training, with no sign language allowed) and proponents of the manual method (where sign language is used) has continued for well over a hundred years. In addition, it should be noted that several camps have formed within the manual method contingency, and debate among these groups is currently receiving considerable attention.

Abbe Carlos Miguel de l'Epee, a famous eighteenth century pioneer in deaf education in France, had a major influence on the methods employed in the first schools for the deaf in the United States. Developing his own system of instruction, de l'Epee took the sign language used in the deaf community in Paris, and supplemented it with additional signs to adapt it to French syntax and morphology (Moores, 1978). He then combined it with the manual alphabet (so words without signs could be fingerspelled) (Abernathy, 1959). de l'Epee taught speech and lipreading, but he saw these as less important than communication of information and spiritual discussion (Garnet, 1968). This approach to teaching, based on signing and fingerspelling, in addition to speech and lipreading training, came to be known as the French Method (Evans, 1982).

In 1815, Thomas Hopkins Gallaudet was asked to estab-

lish a school for the deaf in Connecticut, and he was sent to Europe to observe the oral method in London and the French Method in Paris (Evans, 1982). Difficulties prevented him from studying in England, but he was able to work for a time under Abbe Roch Ambroise Sicard, successor to de l'Epee at the first public school for the deaf in France. Gallaudet returned to the United States, and in 1817 began what is now known as the American School for the Deaf. With slight modification, the practices of the French Method were put into place. Previous to the establishment of this school, American deaf people had little contact with one another. Transportation services were limited, and there were no organizations or activities to bring them together (Baker & Padden, 1978). Immigrants who were deaf may have had knowledge of sign languages from other countries, and native-born deaf children of hearing parents very likely created (as they do now) "home signs" to communicate with their families. However, it was only after Gallaudet's school came about that a real American "deaf community" could be formed (Lane, 1977). Large numbers of the deaf began to interact, and the pooling of local signs with the newly-introduced French sign language became the basis for the sign language in use in the United States today (Woodward, 1978).

For a time American schools were dominated by the French manual method, but eventually the Clarke School was

founded in Massachusetts, dedicated to pure oral teaching. Other such schools followed (Evans, 1982). The oralist philosophy appealed to many, because of its promise to prepare the deaf to fit in with mainstream society. Participants attending the International Congress on Deafness, held in Milan, Italy in 1880, strongly espoused oralism and proclaimed that the use of signs was detrimental to the formation of speech and language (Moores, 1978; Wright, 1969). By the later part of the nineteenth century, there were two broad educational philosophies in the United States, one advocating exclusive oral teaching of the deaf, and the other advocating combining signing with speech and lipreading training. With a host of advocates, including the famous Alexander Graham Bell, oralism gradually became the more popular.

Oral schools held their dominance until the 1970's. During this era, even "manual" schools were often committed to oral teaching at the primary level, while only allowing sign language use at the upper levels (Evans, 1982). However, scrutiny of the results of the oral approach gave rise to dissatisfaction on the part of educators. It became apparent that straight oral methods were more appropriate for children with moderate to severe hearing losses than those with severe to profound hearing losses. Still, firm resistance to manual signs was voiced from certain quarters. Moores (1978) noted that considering the fre-

quent bitterness aroused in some by manual communication, it is surprising that objective research in the area was almost nonexistent until 1965. He added that literature on the subject remains largely position papers.

By the end of the 1960's, renewed interest in manual methods was taking place (Moore, 1978). This change was brought about by a number of factors. First, many children in oral programs did not develop the speech and language skills desired, and educators began to seek concrete adjuncts to traditional oral/auditory techniques. Second, following the work of persons such as Stokoe (1958), sign language was starting to be recognized as a legitimate communication form with all the essential qualities of a spoken language. Many linguists, heavily influenced by Bloomfield (1933), had previously believed that the only true languages were spoken languages. Third, deaf adults were becoming more militant, relating negative experiences in oral schools and standing up for sign language as a symbol of deaf pride and culture. Fourth, research was completed which indicated that deaf children exposed to sign language from early in life had achieved better than youngsters in oral programs (Stevenson, 1964; Meadow, 1966). Fifth, theoretical interest in sign language was raised when several renowned linguists expressed highly critical views concerning pure oral methods (Lenneberg, 1964; Chomsky, cited in Vernon, 1972).

As schools moved away from a pure oral system, they usually adopted a form of signed English for instructional purposes. Signed English combines traditional deaf signs with fingerspelling so communication can take place in English word order. It should be noted that traditional deaf signing was not necessarily done with standard English grammar and syntax. Some systems based on signed English, such as Signing Exact English (Gustason, Pfetzing, & Zawolkow, 1972), include many newly-invented word signs, and additional signs to represent affixes, word endings, and plurality (e.g. "work" + "ing"; "happy" + "ness"; "girl" + "s"). Signing Exact English (known popularly as SEE II) has become the most widely-used system in U.S. schools (Jordan, Gustason, & Rosen, 1979), with its overall intent to get as clear a match as possible between signed, written, and spoken communication.

At the present time, the majority of the programs for the deaf in the United States are based on the philosophy of total communication. Total communication is a multi-media teaching approach which links signed English, speech, and lipreading. Drawing, writing, and pantomime are also accepted options for clarifying ideas, although the most typical presentation is simultaneous speech and manual signs. The goal is to give each student as many cues as possible to facilitate understanding (Brill, 1976).

Research suggests that certain gains have been made

by youngsters exposed to total communication (Brasel & Quigley, 1975; Moores, 1991). Nevertheless, in recent years considerable disappointment has been expressed with respect to the utility of the approach. Total communication has not resulted in the degree of academic progress expected. Some educators have proposed that Ameslan, the natural sign language of the deaf in the United States, be used in its place.

Ameslan

At one end of the manual methods spectrum are signed English and total communication, at the other end is American Sign Language (also known as ASL or Ameslan), a language different from English with its own unique grammar and syntax (Markowicz, 1977; Wilbur, 1979). In Ameslan, word order is changed from English, the copula is omitted, and signed expression is not accompanied by speech. Examples of differences in structure would include the following:

English: "Have you been to California?"

Ameslan: "Touch finish California question-you"
(Note: A hyphenated phrase is completed using one sign.)

English: "He does not need money."

Ameslan: "He need money not he."

English: "Do not touch me."

Ameslan: "Not must touch-me."

Ameslan is a much more condensed language than English, and a ten-word English sentence might be communicated with three Ameslan signs and the appropriate body language. An example would be:

English: "I have told him often, but he still gets careless." (10 signs)

Ameslan: "I-tell-him-repeatedly. He careless-repeatedly." (3 signs)

Ameslan relies much more on the use of space to convey an idea, and Baker-Shenk (1985) points out that subtle movements of the face, head, torso, and eyegaze all contribute to the meaning of what is signed.

Ameslan is referred to as a natural language of the deaf. "Natural" is used to indicate that Ameslan evolved and spread through normal, everyday transactions among persons, just as oral languages are transmitted among hearing people. Ameslan is distinguished from "taught" languages, such as forms of signed English created for school environments, which have to be learned from an instructor.

Actually, both Ameslan and some form of signed English have been extant since the time of Gallaudet (Fant, 1974). However, while Ameslan is used routinely among many deaf adults, classroom use with children was traditionally frowned upon by educators who feared it would interfere with learning English. It was passed on in homes where older deaf family members were present, or picked up

in social gatherings with deaf peers, particularly during adolescence. Recently there has been a change of attitude by certain educators, and some have begun to advocate its early teaching and to assume that it could be a beneficial foundation for later development of English (Stokoe, 1975; Barnum, 1984; Quigley & Paul, 1984). Others have suggested Ameslan is simply a more appropriate vehicle than English for transmitting ideas to young deaf children (Johnson et al., 1989).

Instruction in English Questioned

The use of English, either spoken or manually-signed, is beginning to be questioned as an effective initial communication tool for teaching deaf children. Oral schools use spoken English as the only means of instruction. While clearly no longer the dominant force in deaf education, a number of oral programs are still in operation. Detractors claim that such programs do not work because only a small percentage of words can be visually decoded, and previous knowledge of the language is required to fill in missing parts (Johnson et al., 1989). They point out that pre-lingually deafened children simply do not have this background. Of even greater concern is that these same children are expected to receive, process, and learn all curricular content in this manner.

Total communication approaches were designed to over-

come problems inherent in the oral system, but evidence is accumulating that this may not be the case. First, it is difficult for most persons to consistently speak and sign every word in a message (Marmor & Petitto, 1979). There is a tendency to favor one of the modalities, while omitting key words in the other. Erting (1986), analyzing teacher productions in total communication, reported that a great deal of the speech or signed portions of a conversation were lost.

A second challenge to total communication involves the assumption that exposure to it will lead to better English skills. Supalla (cited in Johnson et al., 1989) studied the signed output of deaf students who for several years had been in what was described as an ideal signed English environment. Although their teacher produced faithful signed renderings of English sentences, the signing of the students did not show evidence of genuine competence in English. He found that each child formed their own personalized grammar, containing innovations quite unlike English, but resembling in some ways natural sign languages.

Use of Ameslan Promoted

Given the problems uncovered in the usage of spoken and manual English, a segment of educators of the deaf has begun to actively promote instruction in Ameslan. Argu-

ments in favor of this have addressed two different populations of deaf children. First of all, deaf children who have deaf parents or older deaf relatives in their home (a little less than 10% of all deaf children) are typically reared in an environment in which they are exposed to a natural sign language from birth (Meadow, 1972). By the time of entry into school, their vocabulary and ability to converse meaningfully are much more developed than in other deaf children their age. Research has indicated that such children are more advanced academically, and that a thorough grounding in the Ameslan symbol system is actually beneficial to later English acquisition (Barnum, 1984). A parallel is drawn to bilingual hearing children, where theory suggests allowing full development of a native language base before introducing a second language. It is thus recommended that young deaf children already familiar with Ameslan be taught curricular subjects in this language, and only gradually be exposed to more English.

A second, larger group of deaf children--those who have hearing parents and relatives in their home (about 90% of all deaf children)--have never had early experiences with Ameslan. Here it is reasoned that since the English signal systems are assumed to be distorted, a viable alternative would be to provide early education environments where native Ameslan-signing models are present. In this way a full, naturally-acquired sign language system would

begin to evolve. As described above, school subjects would be taught in Ameslan, with English introduced at a later point.

Rationale for the Present Research Project

So far, the discussion of the advisability of teaching deaf children in either English or Ameslan has centered primarily on the issues of ease and completeness of early symbol system acquisition, and the ability of such a system to promote later conversational, reading, and writing skills. These areas, of course, are the traditional focus of the educator of the deaf. The attempt here, however, is to broaden the discussion somewhat to include a related issue, the relative capacity of each of these languages to facilitate information processing. In other words, in addition to asking how readily and accurately English or Ameslan can be acquired, one might also ask if there is something in the structure and presentation of one language which might help a deaf child comprehend or encode a message better.

Natural sign languages similar to Ameslan are found throughout the world. Deaf children, even in the absence of signing models, create their own rule-governed language which they use among themselves (Goldin-Meadow & Feldman, 1975). What they invent resembles Ameslan in its grammatic structure, though it will differ in actual signs (Fant,

1974). Is there something about an Ameslan-type format which more efficiently or effectively meets the communication needs of a person with limited hearing? Utilizing concepts from information-processing theory (Andre & Phye, 1986), there is some indication that this may be the case.

As discussed above, findings from many studies seem to suggest flaws in the total communication approach. Also, logical arguments can be formulated which describe why Ameslan might be a better communication vehicle. Nevertheless, before considering a methodological change, further research must be completed. As yet, there is much more "educated opinion" than hard data suggesting that Ameslan may be the method of choice. Experimentation has begun with immersion of young children in Ameslan environments. Similar study is also being undertaken in Sweden, where youngsters taught in signed Swedish are being compared with those placed in a setting where the natural Swedish Sign Language is used (Moores, 1991). However, it will take a few years before any results on language acquisition or skill development are available.

While research on immersion in Ameslan environments is in its beginning stages, even less work has been done assessing the information processing capacities of Ameslan and total communication. If a significant difference between the languages were detected, this would provide an important piece of information in determining if Ameslan

should be implemented or total communication retained. It may also be discovered that one language would be preferable for a particular type of child, but not for another. The study to be reported here was designed with these ideas in mind. Fifty-four children, enrolled in an elementary school deaf program, were presented with a series of stories using both Ameslan and the total communication approach. The children, both regular deaf program students and students with additional learning disabilities, were then compared with respect to their relative ability to comprehend and recall information across languages (Ameslan, total communication). The specific goals of the investigation were as follows: 1) To determine if Ameslan is easier than total communication for deaf children to understand and remember. 2) To determine if this influence varies with age. 3) To determine if this influence varies when additional learning problems are present. 4) To determine if this influence varies according to the language spoken by the family (English-speaking family, non-English speaking family).

CHAPTER II

REVIEW OF LITERATURE

Information-processing theory has dominated learning and cognitive psychology since the mid-1960's (Andre & Phye, 1986). It is based on one central metaphor--that the brain/mind system is, in important ways, like a programmable computer. This metaphor implies that concepts from the area of computer science can be used to understand what human beings do when they learn, remember, and utilize knowledge. The mind is portrayed as a structure consisting of components for processing information (storing, retrieving, transforming, and using it) and procedures for activating these components.

There have been differences of opinion regarding the exact nature of mental structure, and over the years various models have been offered in an attempt to simulate cognitive functioning. As an example, Atkinson and Shiffrin (1968) postulated a mental system with five major components. These components included:

1. Sensory registers where incoming stimuli are held for a brief period until they can be processed.
2. A short-term memory that contains information currently being thought about.
3. A long-term memory which retains information over

- an extended period of time.
4. An executive which tracks data being processed and determines which activities will occur next.
 5. Output buffers which can execute well-learned skills without the use of much conscious attention.

Any such model is of little value in describing the actual physiology of learning, but can be quite useful in delineating a learning sequence and targeting what an educator must do to enhance it.

In the present study, an information-processing framework is utilized as a context in which to articulate the relative merits of Ameslan and total communication. Borrowing from the work of Atkinson and Shiffrin and similar mental models (e.g., Baddeley & Hitch, 1974; Baddeley, 1986), the assumption made is that for adequate learning to take place, adequate attention, adequate short-term memory encoding, and adequate long-term memory encoding must precede it. In what follows, relevant research will be reviewed in an attempt to support the notion that Ameslan or total communication is more facilitative of these processes. Studies on attention and memory skills in the deaf will be examined, including those which relate specifically to the monitoring and recall of manual signs. Suggested implications for sign language methods will be outlined, as well as recent investigations which actually compare message comprehension in Ameslan and total communication.

Attentional Skills of the Deaf

Results from a number of studies have indicated that, with regard to visual stimuli and sustained visual attention, the deaf are equal to or superior to the hearing. Attention span deficits have not been indicated on measures such as the Hiskey-Nebraska Test of Learning Aptitude, a nonverbal test designed specifically to assess cognitive abilities in the deaf (Hiskey, 1966). Dittmar, Berch, and Warm (1982) asked adult subjects to monitor a visual display continuously over a 45 minute period, attempting to detect occasional increments in a horizontal bar of light. The deaf participants spotted significantly more changes than the hearing participants, with no higher incidence in false alarm rates. Similar findings were obtained by Parasnis and Samar (1985). At one time, researchers (e.g., Hayes, 1933) had tried to explain such results favoring the hearing-impaired by reference to sensory compensation, an hypothesized heightened physiological sensitivity to visual stimuli (much as the blind were said to have heightened physiological sensitivity to auditory stimuli). Current theorists reject this notion, suggesting instead that the deaf out of necessity have merely learned to use their visual monitoring system more efficiently.

While research findings support the premise that the general population of the deaf have well-developed attentional skills, it should be noted that there is a large

sub-group in this population in which this is likely not the case. Many children (approximately 37%) are deafened due to pre- or post-natal trauma (e.g., Rubella, prematurity, RH incompatibility, meningitis, and other insults)(Brown, 1986). Survey results have provided documentation of higher incidences of neurological, learning, and behavioral problems in these youngsters (Zwirecki, Stansberry, Porter, & Hayes, 1976; Jensema & Mullins, 1974). Although not addressed specifically in the data described, a reasonable assumption is that quite a few of these children have decreased attentional abilities. The presence of attentional problems would in turn interfere with short-term memory processing (Chalifoux, 1991).

Attention and Processing of Sign Language

For the most part, research efforts related to attention and processing of sign language have focused on differences in sign production rates and receptive system overloading. Baker (1978) compared production rates of hearing signers using signs alone and those using signs and speech simultaneously. Results indicated that the simultaneous approach caused a decrease in normal speaking and normal signing speed. The slowdown was attributed to cross-channel production problems. Baker noted that the difficulty was less intense when the simultaneous communication group used Pidgin Signed English (an abbreviated

form of signed English) as opposed to another form of manually coded English (such as SEE II, where extra words, affixes, and suffixes are added). The implication is that the simultaneous method, particularly when using a system such as SEE II, is more cumbersome and likely to place unnatural receptive demands on a deaf child (Livingston, 1986).

In a similar vein, signed English and Ameslan have been compared in regard to ease of reception. Signed English requires a larger number of signs to represent the derivational and inflectional components of English grammar. It has been suggested that because of this, it may place an excessive load on neurological processing (Mitchell, 1982; Wilbur, 1979).

Short-term Memory and Encoding in the Deaf

The first research on memory in the deaf consisted largely of comparative studies with hearing subjects. Pintner and Patterson (1917) found hearing children significantly better than deaf children in memory for visually-presented digit sequences. Blair (1957) found deaf children superior on cube tapping and geometric design recall, but markedly weaker on digit span and picture sequence recall. She concluded weaknesses in the deaf were attributable to reduced capacity for abstraction and a lack of auditory/verbal imagery for effective coding.

Furth (1966) noted that on tasks which do not have a language component, there are no visual memory differences between the deaf and the hearing. Deaf subjects remembered nonsense pictures at the same rates as hearing subjects. While not doing as well on visual memory for digits, the deaf did better when digits were presented simultaneously rather than sequentially. Furth raised the question of whether the deaf remember spatial stimuli more easily than temporal stimuli. O'Connor and Hermelin (1973) added that if given a choice, deaf subjects preferred spatial configurations, with temporal processing possibly more difficult for them. However, McDaniel (1980) drew different conclusions, pointing out that once the role of language was minimized or eliminated, memory skills in the deaf did not differ from those of the hearing over a wide variety of tasks, including tasks with temporally-presented stimuli.

Conrad (1964) was center stage with respect to his early research regarding short-term memory encoding in the deaf. Deaf and hearing subjects were shown visual displays of letters or words, and once a display was removed, they were asked to write what they remembered. Types of encoding were inferred from the types of errors made (e.g., errors which sounded similar to the original stimulus, as opposed to error choices which looked similar to the original stimulus). Conrad concluded that the hearing use an

acoustic-based (sound-based) code, and were superior in memory to the deaf, who used a visually-based code. These findings were supported by the work of Wallace and Corballis (1973).

Hintzman (1967) proposed that encoding in the hearing was more accurately described as "articulatory" than acoustic. Hintzman felt that how a letter or word was articulated on the mouth was as important in encoding as the actual sound made. Accepting the term articulatory, Conrad (1970) divided deaf children into two groups, articulatory encoders and non-articulatory encoders. The small number of deaf classified as articulators tended to be those ranked highest by teachers for speech skills and speech quality. Conrad (1972) found, however, that even those children who were advanced articulators did not do as well as hearing children on memory tasks. He noted that articulatory encoding in the deaf needs to be supplemented by other encoding forms.

Studies of short-term memory using manual signs as stimuli indicate that in addition to the visual/spatial encoding documented in earlier experiments with the deaf, there is a kinesthetic component as well (Chalifoux, 1991). Bellugi, Klima, and Siple (1975) presented sequences of signs to subjects, having them later write what was recalled. They concluded that the deaf rely on a sign-based

code rather than an acoustically- or semantically-based code (errors were influenced by similarities of hand formation, rather than similarities of sound or meaning). The findings reported by Frumkin and Anisfeld (1977) conflicted with those of Bellugi et al. somewhat, as deaf children in this study appeared to rely heavily on semantic coding, even moreso than hearing children. Frumkin and Anisfeld hypothesized that the deaf may have relied on semantics more to compensate for the lack of articulatory encoding. The issue of semantic encoding remains unresolved at this point (Chalifoux, 1991).

Hamilton and Holzman (1989) presented a list of phonologically-related, cherologically-related (related to shape and location of manual sign movements), and control words to three groups of hearing and three groups of deaf subjects. The hearing groups consisted of those with no experience with sign language, those with spoken English as a first language who had learned sign language, and those with sign language as a first language and spoken English as a second (hearing children of deaf parents). The deaf groups consisted of those with spoken English as a first language (persons deafened after age six), congenitally deafened persons whose first language was sign language who had learned spoken English, and congenitally deaf persons with sign language skills but no spoken English. Stimuli

to be remembered were presented orally, manually, and in oral/manual combination. Encoding flexibility was seen in most groups, and was highly dependent on the characteristics of incoming information. Hearing and deaf subjects encoded oral material phonologically, and manual material cherologically. All groups, except the congenitally deaf, tended to encode the bimodal material phonologically, suggesting that early exposure to language may bias short-term memory encoding. Hamilton and Holzman stated that bimodal presentation can potentially enhance the signal, pointing out that subjects with combined experience with speech and sign language recalled items better than with presentations using a single modality. However, groups with early exposure to speech and sign language did not include the congenitally deaf, who performed poorly on this task. For them, there is evidence that a bimodal approach may act to overload their encoding system (Chalifoux, 1991). Hamilton and Holzman added that hearing subjects with no sign language experience had lower scores, but still ranked higher than deaf subjects without speech experience.

Finally, it should be noted that Chalifoux (1991) proposed a model of working memory (short-term memory) in the deaf based on Baddeley's model of working memory (Baddeley, 1986). The model appears to be useful with respect to describing and summarizing encoding processes

delineated from a review of over 25 years of research with the hearing-impaired. The model includes four components:

1. A central executive, which allocates attention and controls the other components of working memory.
2. An articulatory unit, which uses a speech-based code. As in Baddeley's model, speech rehearsal, either overt or covert, allows items to be carried in working memory and rehearsed.
3. A visuo-spatial unit, which for the deaf would be heavily involved in encoding sign language and/or lipreading.
4. A sign unit, which would have a large kinesthetic component, though it could not be separated from the visuo-spatial unit.

Short-term Memory and Processing of Sign language

Studies of short-term memory processing of sign language have addressed differences in sign production rates (as in studies of attention) and relative capacities of language forms to facilitate "chunking". Klima and Bellugi (1979) noted that while it takes twice as much time to sign a particular word in Ameslan as to speak it, propositions of a communication proceed at the same rate in both languages. They proposed that there is a common underlying temporal process in all natural languages which governs the rate of producing such propositions. However, when a system such as SEE II is used, extra sign units are required, and the normal rate is disrupted. In a given period, there is less time for rehearsal of information, and less encoded.

Chunking is a concept introduced by Miller (1956). He used "chunks" to describe the number of separate items which can be held in short-term memory at one time. Even with considerable practice one cannot increase the number of chunks one can hold, but one can increase the amount of information contained in each chunk. Klima and Bellugi (1979) found that the deaf were able to remember an average of 5.9 items in words, but only 4.9 items in signs. Given that the use of signs appears to reduce the average number of chunks, it would be of importance for short-term memory to use a form of sign language which is most likely to facilitate formation of larger chunks.

Long-term Memory and Encoding in the Deaf

While hearing persons store information in short-term memory in an acoustic form, they code information in long-term memory according to semantic or conceptual relations (Baddeley, 1986). Available research indicates similar long-term encoding in the deaf. Siple, Fischer, and Bellugi (1977) presented deaf students with a series of manual signs and printed words. Later, students were given lists and asked to identify words they had been shown. Typical errors made were choices of words similar in meaning rather than similar in appearance to the stimulus. Thus, while the primary short-term memory code for the deaf is visuo-spatial, the long-term memory code is semantic.

Numerous experiments with hearing subjects have documented the role of imagery in facilitating long-term recall. Imaginal or pictorial representation can increase memory 1.5 to 3 times (Bower & Hilgard, 1981). Conlin and Paivio (1975) presented series of words to deaf adults, and found that they consistently remembered high imagery words better. Given these findings, it appears that imagery augments the semantic code in both the hearing and the deaf.

Long-term Memory and Processing of Sign Language

I was unable to find any research reported in the literature which specifically compared types of sign language and their relative ability to facilitate long-term memory. Hopefully, the study to be reported here will provide useful information in this regard. It seems reasonable, however, to hypothesize that a sign language which possesses a high degree of imagery would have an advantage for later recall.

Implications of the Research Related to the Ameslan/Total Communication Debate

To summarize the research findings, deaf children seem to be at a disadvantage on all language-mediated memory tasks. Their attention is generally adequate, though a large sub-group of the deaf population is at greater risk for learning problems, behavior problems, and by inference, attention problems. Bimodal oral/manual

communication tends to disturb the normal rate of reception in deaf children, and appears to overload their system of encoding in short-term memory. Additionally, use of sign language itself reduces the number of information chunks that can be acted upon at one time. A sign language which would seemingly best suit the processing needs of the deaf would be unimodal, compact in terms of the amount of information that could be transmitted per sign, exploitative of spatial forms of conveying ideas, and rich in imagery. It would appear that Ameslan has the advantage over total communication in all these respects.

Ameslan is not accompanied by speech, whereas total communication requires the use of speech with signs. As was mentioned earlier, Ameslan can convey the same idea with considerably fewer signs, and it can provide more information per sign. An example would be:

English: "All five ran over and ganged up on him."

Ameslan: Modified "meet" sign used. Meaning of "ganged up" conveyed by the nature of the hand motion (how they went over to him and where he stood in relation to them), and their number conveyed by the number of fingers raised on one of two hands needed to make this sign.

Both total communication and Ameslan use visual imagery to communicate ideas, but due to Ameslan's greater reliance

on space and body language, it should be richer in this respect. Examples would include:

English: "This work is very hard!"

Ameslan: "Work" sign is repeated several times. Varied speed and pacing of the repetition is combined with various facial expressions to convey "hard", e.g., tiring work, boring work, working under pressure, working rapidly, etc.

English: "First the boy hit the girl. Then she started crying. Then he laughed."

Ameslan: "boy" -- Signer makes sign and by pointing places the boy in an imaginary space to his right.
 "girl" -- Signer makes sign and by pointing places the girl in an imaginary space to his left.
 "hit" -- Sign moves from signer's right to left, mimicking the emotion of the original incident.
 "cry" -- Signer faces right, taking the girl's position in space, and indicates how the girl cried.
 "laugh" -- Signer faces left, taking the boy's position and conveying the proper emotion.

Total communication will tell you what happened, but Ameslan is likely to show you what happened and how.

Implications of the Research for the Present Study

Based on a selective view of the literature, there is reason to believe that Ameslan may be easier for deaf children to process than total communication. However, there has been little research which has tested this directly.

Furthermore, the work that has been done has examined differences on comprehension measures alone, and has not addressed possible effects on short- and long-term recall.

In one study, described in Livingston (1986), ten deaf children ages 6 to 16 were signed a series of sentences and one short paragraph. Subjects were then asked to manipulate doll house people and furniture to show their comprehension of each communication. Items were presented initially in signed English, but if misunderstood were presented again using Ameslan. Findings indicated that for short, less complex information, the children were able to suitably comprehend the signed English. However, with longer messages, messages which were syntactically complex, or messages which conveyed spatial relationships, the children understood Ameslan better.

A similar study was completed by Eagney (1987). Subjects ages 5 to 15 were signed a series of 25 sentences of increasing difficulty. The children were randomly assigned to one of three conditions: presentation in Ameslan, presentation in signed English, or presentation in simplified signed English with low syntactic complexity. Children used toy figures and furniture on which directions were carried out. In this study, no differences were found across language presentations or age.

The study described here was designed to test differ-

ences in comprehension of Ameslan and total communication, and additionally to examine the influences of each language on short- and long-term memory. The comprehension task differed somewhat from those in the research just described, and was chosen to more closely resemble responses in a school setting. Memory tasks were included, not merely to lend support in resolving theoretical issues, but because enhancement of recall is so crucial to the teaching/learning environment of the classroom.

Research in this area is limited somewhat because relatively few deaf youngsters have a background in Ameslan. Consequently, no comparisons have been made between children with a language base in Ameslan and children with a language base in signed English/total communication. So far, comparative studies have only involved children with no previous experience in Ameslan. This was also the case in the study to be reported here. However, while the languages differ in presentation and grammar, the signs used are the same (Fant, 1974). There is evidence that children with a background in signed English can still understand Ameslan equally well (Luetke-Stahlman, 1990; Eagney, 1987). In fact, this in itself may be an indication of how appropriate Ameslan is for deaf children, or alternatively, how difficult English is for them to decode.

CHAPTER III

METHOD

Hypotheses

The following null hypotheses were tested:

1. There will be no differences in immediate recall scores, delayed recall scores, and comprehension scores across methods of sign language presentation (Total Communication, Ameslan).

2. There will be no differences in immediate recall scores, delayed recall scores, and comprehension scores across age levels (6 to 9 year olds, 10 to 12 year olds, 13 to 15 year olds).

3. There will be no differences in immediate recall scores, delayed recall scores, and comprehension scores across learner types (Regular Deaf Program, Deaf Learning Disabled Program).

4. There will be no differences in immediate recall scores, delayed recall scores, and comprehension scores across family language types (English-speaking family, non-English speaking family).

5. There will be no significant interactions among methods of sign language presentation (Total Communication,

Ameslan), age levels (6 to 9 year olds, 10 to 12 year olds, 13 to 15 year olds), immediate recall scores, delayed recall scores, and comprehension scores.

6. There will be no significant interactions among methods of sign language presentation (Total Communication, Ameslan), learner types (Regular Deaf Program, Deaf Learning Disabled Program), immediate recall scores, delayed recall scores, and comprehension scores.

7. There will be no significant interactions among methods of sign language presentation (Total Communication, Ameslan), family language types (English-speaking family, non-English speaking family), immediate recall scores, delayed recall scores, and comprehension scores.

8. There will be no significant interactions among methods of sign language presentation (Total Communication, Ameslan), learner types (Regular Deaf Program, Deaf Learning Disabled Program), age levels (6 to 9 year olds, 10 to 12 year olds, 13 to 15 year olds), immediate recall scores, delayed recall scores, and comprehension scores.

9. There will be no significant interactions among methods of sign language presentation (Total Communication, Ameslan), family language types (English-speaking family, non-English speaking family), age levels (6 to 9 year olds, 10 to 12 year olds, 13 to 15 year olds), immediate recall scores, delayed recall scores, and comprehension scores.

Subjects

The subjects used in this study were 54 students, ages 6 to 15, enrolled in an urban, public day school program for the deaf. The teaching modality in the program was total communication, with none of the youngsters having any previous formal exposure to Ameslan. Thirty-three of the children were students in the regular deaf program, while 21 were students with additional learning disabilities. All of the subjects were children of hearing parents, a majority were members of racial/ethnic minority groups (Hispanic: 27, African american: 18, Asian: 3, White non-Hispanic: 6), and a majority were from low income or blue collar families.

Measures of Information Processing

A range of story passages of varying complexity was selected to be signed to the children to assess short-term recall, long-term recall, and comprehension. Simple scoring systems were devised to quantify performance on each type of task. Stories were adapted from a language series called The New Language Stories and Drills (Crocker, Jones, & Pratt, 1966), and were in certain cases modified slightly to facilitate manually-signed presentation (e.g., signs did not exist for a few of the written words--words of similar meaning were substituted).

Immediate Recall Passages--Forms A & B

Each form of the Immediate Recall Passages was composed of a series of five short stories, arranged in order of increasing length and difficulty (see Appendix A). At the completion of a passage, the subject was asked to retell it from memory. Responses were scored one point for every relevant detail remembered. Presentation of either form was suspended if three consecutive stories were signed with no scorable responses elicited.

Delayed Recall Passages--Forms A & B

Each form of the Delayed Recall Passages consisted of one short story (see Appendix B). A passage was signed to a subject, who was then asked to retell it one day later. Responses were scored one point for every relevant detail remembered.

Comprehension Passages--Forms A & B

Each form of the Comprehension Passages was composed of a series of five short story passages, arranged in order of increasing length and difficulty (see Appendix C). After each was signed, a number of informational questions were addressed to the subject. Answers were scored one point for each correct response. Presentation of either form was suspended if three consecutive stories were signed with no scorable responses elicited.

Methods of Sign Language Presentation

The total communication method used to present story passages consisted of simultaneous signed English and speech. Each story was signed in correct English word order, with the articles and copula included. It should be noted that special prefixes and word endings typical of the SEE II system were not used (with the exception of adding "s" for plural forms), as this method was not employed at the school the subjects attended, and was thus unfamiliar to them.

A native Ameslan-signing deaf adult was consulted to ensure that the presentation of passages in Ameslan was correct. Fant (1983) was also used as a reference in this regard.

Procedure

The subjects were examined in two series of experimental sessions arranged approximately three months apart. At the beginning of the study, each participating child was randomly assigned to one of four story presentation sequences, which were set up in the following counter-balanced order;

	Initial Sessions:	Later Sessions:
Subj. 1	Receives Form A in total communication, Form B in Ameslan	Receives Form A in Ameslan, Form B in total communication

	Initial Sessions:	Later Sessions:
Subj. 2	Receives Form A in Ameslan, Form B in total communication	Receives Form A in total communication, Form B in Ameslan
Subj. 3	Receives Form B in total communication, Form A in Ameslan	Receives Form B in Ameslan, Form A in total communication
Subj. 4	Receives Form B in Ameslan, Form A in total communication	Receives Form B in total communication, Form A in Ameslan

(The entire series was repeated, with Subject 5 being assigned the same story presentation as Subject 1, Subject 6 assigned the same presentation as Subject 2, etc.)

Given this arrangement, all the children were at some point administered both forms of the Immediate Recall Passages, Delayed Recall Passages, and Comprehension Passages in both sign language modalities (Ameslan and total communication). Thus, rather than placing children in separate experimental and control groups, each subject could be compared against himself/herself. Scores on the same passages signed to the same child could be obtained for Ameslan and total communication presentation, and the differences between the modalities could be calculated for the entire group.

Design and Statistical Analysis

Analytic Paradigm #1:

Sign Language Methods				
Ameslan X_{1a}		Total Communication X_{1b}		
Regular Deaf X_{3a}	L.D. Deaf X_{3b}	Regular Deaf X_{3a}	L.D. Deaf X_{3b}	
Ages 6 to 9 X_{2a}				
Ages 10 to 12 X_{2b}				Immediate Recall Passages scores Y_1 Delayed Recall Passages scores Y_2 Comprehension Passages scores Y_3
Ages 13 to 15 X_{2c}				

Independent Variables

1. Ameslan, Total Communication X_{1a} , X_{1b}
2. Age (ages 6 to 9, ages 10 to 12, ages 13 to 15)
 X_{2a} , X_{2b} , X_{2c}
3. Learner Types (Regular and L.D. Deaf) X_{3a} , X_{3b}

Dependent Variables

1. Immediate Recall Passages scores Y_1
2. Delayed Recall Passages scores Y_2
3. Comprehension Passages scores Y_3

Statistical Analysis

2 X 2 X 3 repeated measures ANOVA

Analytic Paradigm #2:

Sign Language Methods			
Ameslan X_{1a}		Total Communication X_{1b}	
English-speaking Family X_{3a}	Non-English speaking Family X_{3b}	English-speaking Family X_{3a}	Non-English speaking Family X_{3b}
Ages 6 to 9 X_{2a}			
Ages 10 to 12 X_{2b}	Immediate Recall Passages scores Y_1 Delayed Recall Passages scores Y_2 Comprehension Passages scores Y_3		
Ages 13 to 15 X_{2c}			

Independent Variables

1. Ameslan, Total Communication X_{1a} , X_{1b}
2. Age (ages 6 to 9, ages 10 to 12, ages 13 to 15)
 X_{2a} , X_{2b} , X_{2c}
3. Family Language Type (English-speaking, non-English speaking) X_{3a} , X_{3b}

Dependent Variables

1. Immediate Recall Passages scores Y_1
2. Delayed Recall Passages scores Y_2
3. Comprehension Passages scores Y_3

Statistical Analysis

2 X 2 X 3 repeated measures ANOVA

CHAPTER IV

RESULTS

Analysis of the Data

A 2 (sign language methods) by 2 (learner types) by 3 (age levels) ANOVA for repeated measures was performed on memory and comprehension scores from the Immediate Recall Passages, the Delayed Recall Passages, and the Comprehension Passages. Analysis of the data revealed significant main effects for age levels ($p < .001$) and learner types ($p < .001$). However, the main treatment effect for sign language methods was not found to be significant. The two-way interaction of sign language methods and age levels was significant at the .01 level. However, the interaction of sign language methods and learner types was not found to be significant. The three-way interaction of sign language methods, age levels, and learner types was significant at the .05 level. ANOVA findings are summarized in Table 1.

Table 1.--Results of Multivariate Tests, ANOVA #1

Source of Variance	Df	F	p
Sign Language Methods	1	2.01	.16
Age Levels	2	19.15	.000*
Learner Types	1	38.44	.000*
Sign Language Methods by Age Levels	2	4.90	.01
Sign Language Methods by Learner Types	1	.63	.43
Sign Language Methods by Age Levels by Learner Types	2	3.17	.05

* $p < .001$

Comparisons of the mean scores of the sign language methods by age levels interaction were performed using Fisher's LSD technique (see Table 2). Passage presentation in Ameslan resulted in significantly higher Immediate Recall Passages scores for the 6 to 9 year old group ($p = .01$) and the 10 to 12 year old group ($p = .05$), significantly higher Delayed Recall Passages scores for the 6 to 9 year old group ($p = .025$) and the 10 to 12 year old group ($p = .025$), and significantly higher Comprehension Passages

scores for the 6 to 9 year old group ($p = .05$). In an attempt to enhance clarity, these relationships are illustrated separately for each of the dependent measures (see Figures 1, 2, and 3).

Table 2.--Mean Scores of the Immediate Recall Passages (IRP), Delayed Recall Passages (DRP), and Comprehension Passages (CP), Showing the Sign Language Methods by Age Levels Interaction

	IRP	DRP	CP
	\bar{X}	\bar{X}	\bar{X}
Ages 6 to 9			
Total Communication	16.810	4.905	16.476
Ameslan	23.095***	10.000**	20.762*
Ages 10 to 12			
Total Communication	27.556	8.889	35.000
Ameslan	31.889*	13.778**	37.333
Ages 13 to 15			
Total Communication	30.600	15.133	37.733
Ameslan	30.067	18.800	38.800

- * significant at .05 level
 ** significant at .025 level
 *** significant at .01 level

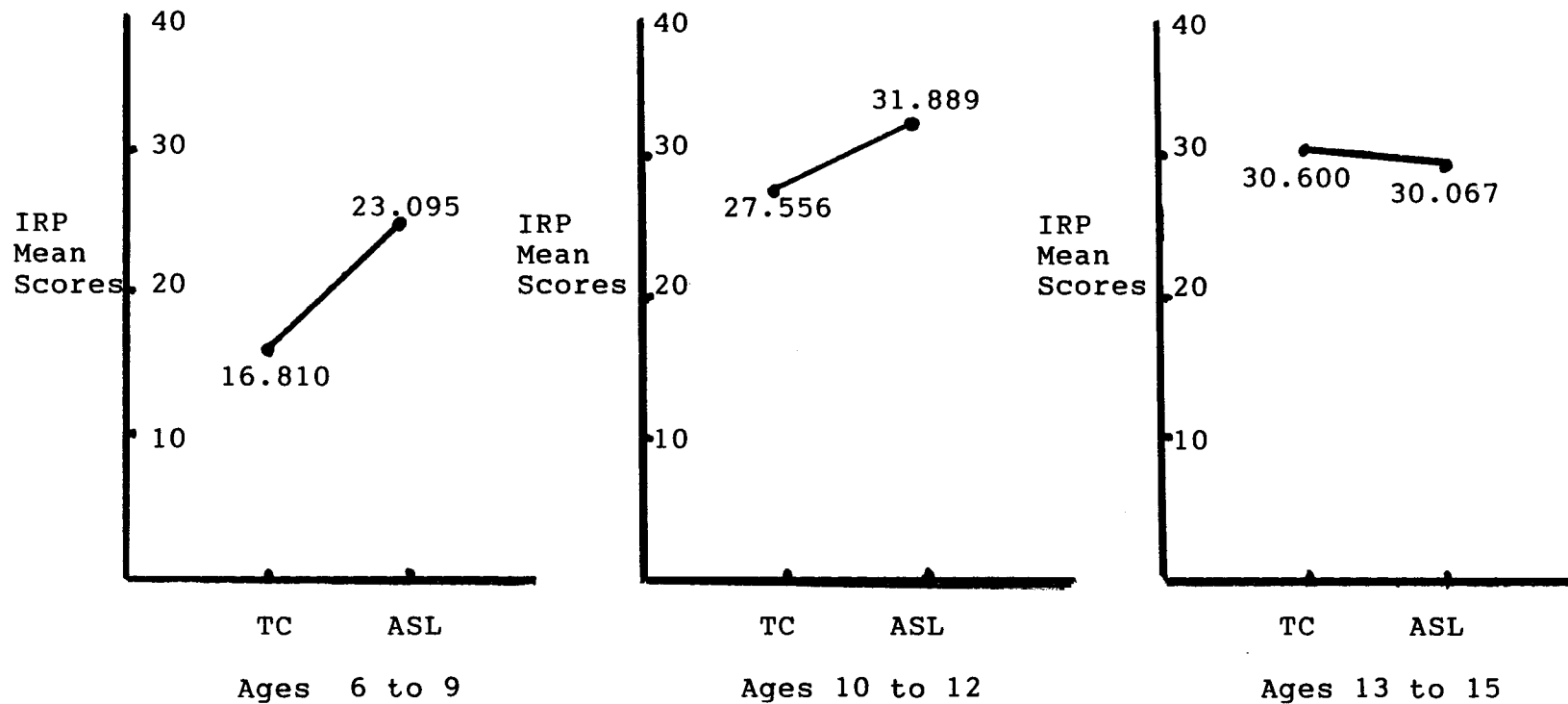


Fig. 1 A comparison of mean scores on the Immediate Recall Passages (IRP), illustrating the Sign Language Methods by Age Levels interaction.

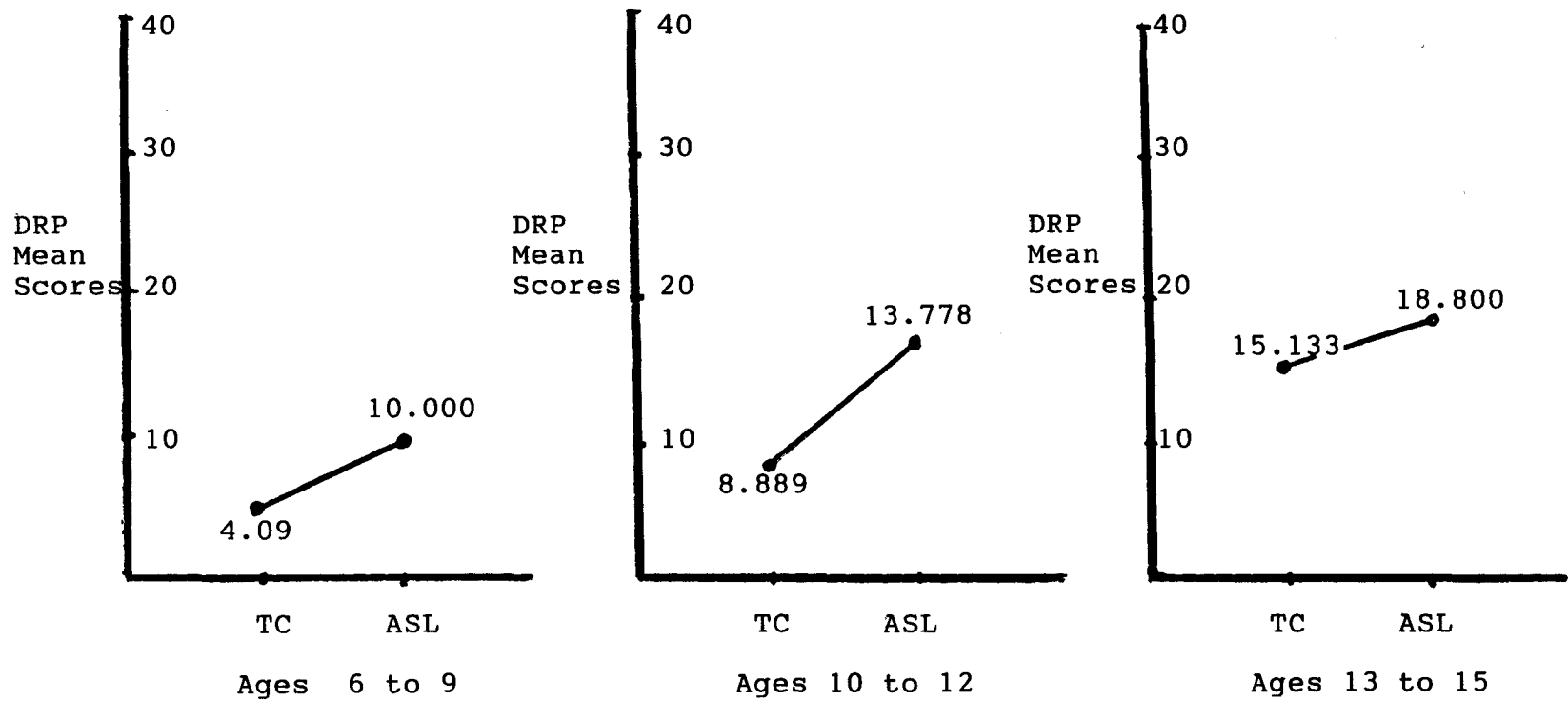


Fig. 2 A comparison of mean scores on the Delayed Recall Passages (DRP), illustrating the Sign Language Methods by Age Levels interaction.

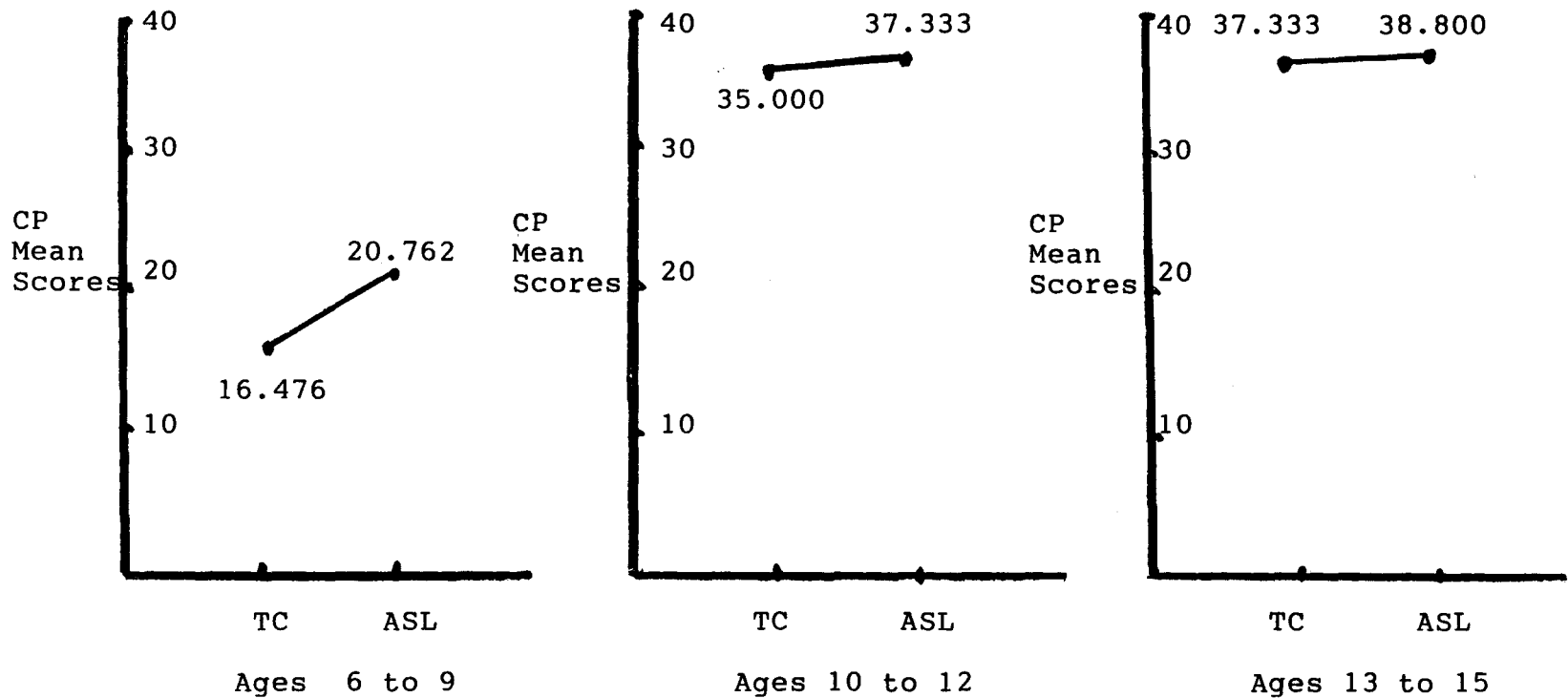


Fig. 3 A comparison of mean scores on the Comprehension Passages (CP), illustrating the Sign Language Methods by Age Levels interactions.

Comparisons of the mean scores of the sign language methods by age levels by learner types interaction were performed using Fisher's LSD technique. Passage presentation in Ameslan resulted in significantly higher Immediate Recall Passages scores and Delayed Recall Passages scores for the 6 to 9 year olds in the regular deaf program ($p = .05$)(see Table 3). Once again, in an attempt to enhance clarity, these relationships are illustrated separately for each of the dependent measures (see Figures 4, 5, and 6).

Table 3.--Mean Scores on the Immediate Recall Passages (IRP), Delayed Recall Passages (DRP), and Comprehension Passages (CP), Showing the Sign Language Methods by Age Levels by Learner Types Interaction

		IRP	DRP	CP
		\bar{X}	\bar{X}	\bar{X}
Regular Program Students				
Ages 6 to 9	Ameslan	28.615*	12.462*	24.538
	Tot Com	21.769	6.000	20.231
Ages 10 to 12	Ameslan	35.750	15.167	43.750
	Tot Com	31.833	10.750	42.333
Ages 13 to 15	Ameslan	37.875	20.750	47.000
	Tot Com	38.875	18.000	47.000
Learning Disabled Students				
Ages 6 to 9	Ameslan	14.125	6.000	14.625
	Tot Com	8.750	3.125	10.375
Ages 10 to 12	Ameslan	24.167	11.000	24.500
	Tot Com	19.000	5.167	20.333
Ages 13 to 15	Ameslan	21.143	16.571	29.429
	Tot Com	21.143	11.857	27.143

* significant at .05 level

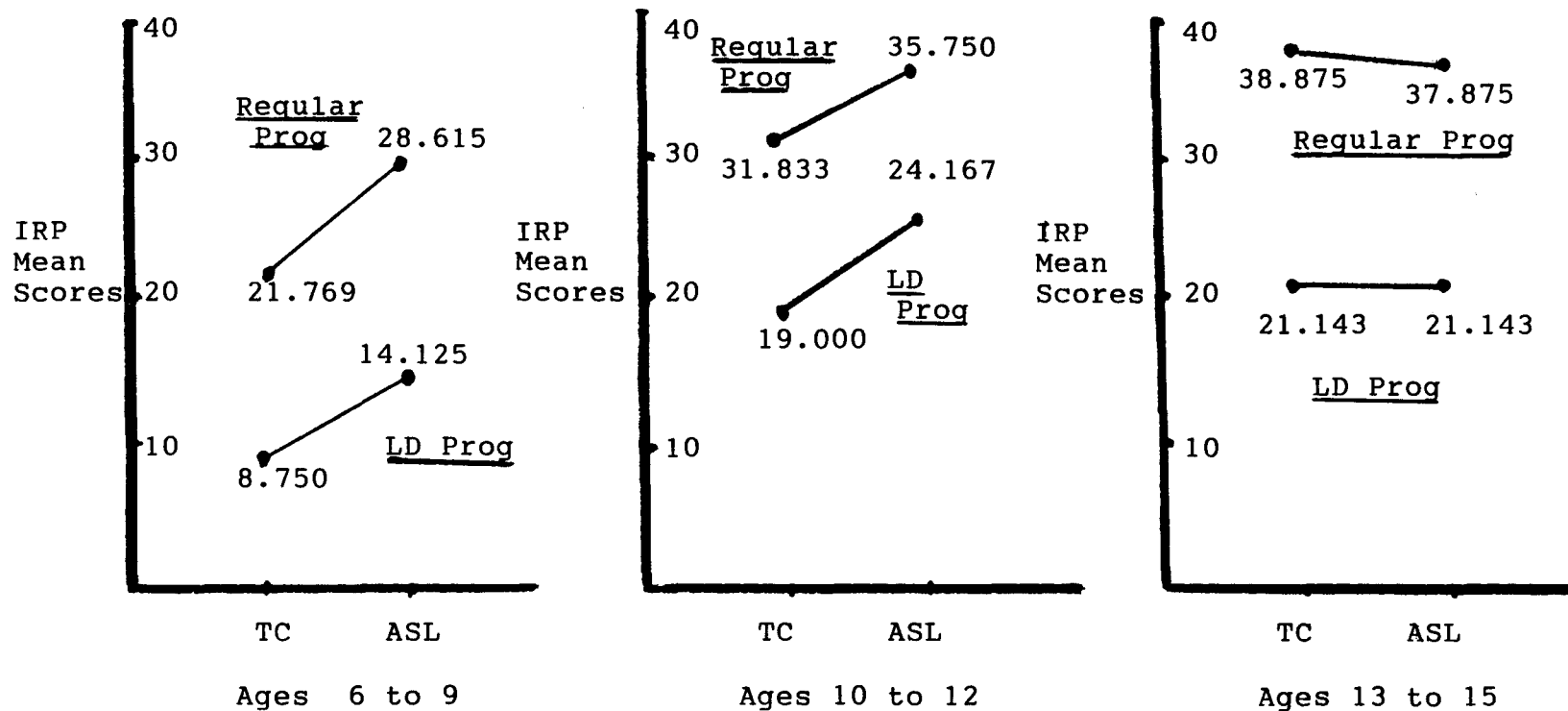


Fig. 4 A comparison of mean scores on the Immediate Recall Passages (IRP), illustrating the Sign Language Methods by Age Levels by Learner Types interaction

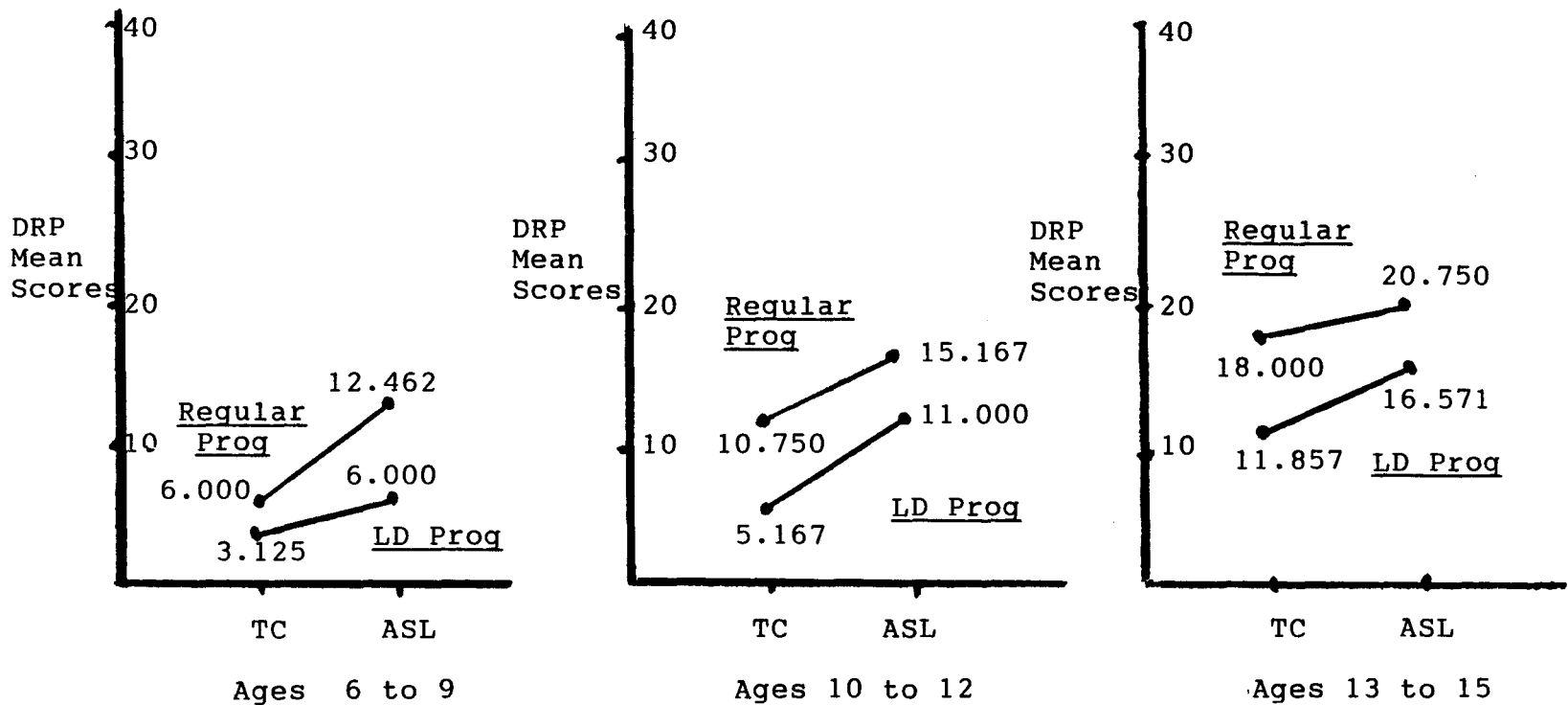


Fig. 5 A comparison of mean scores on the Delayed Recall Passages (DRP), illustrating the Sign Language Methods by Age Levels by Learner Types interaction

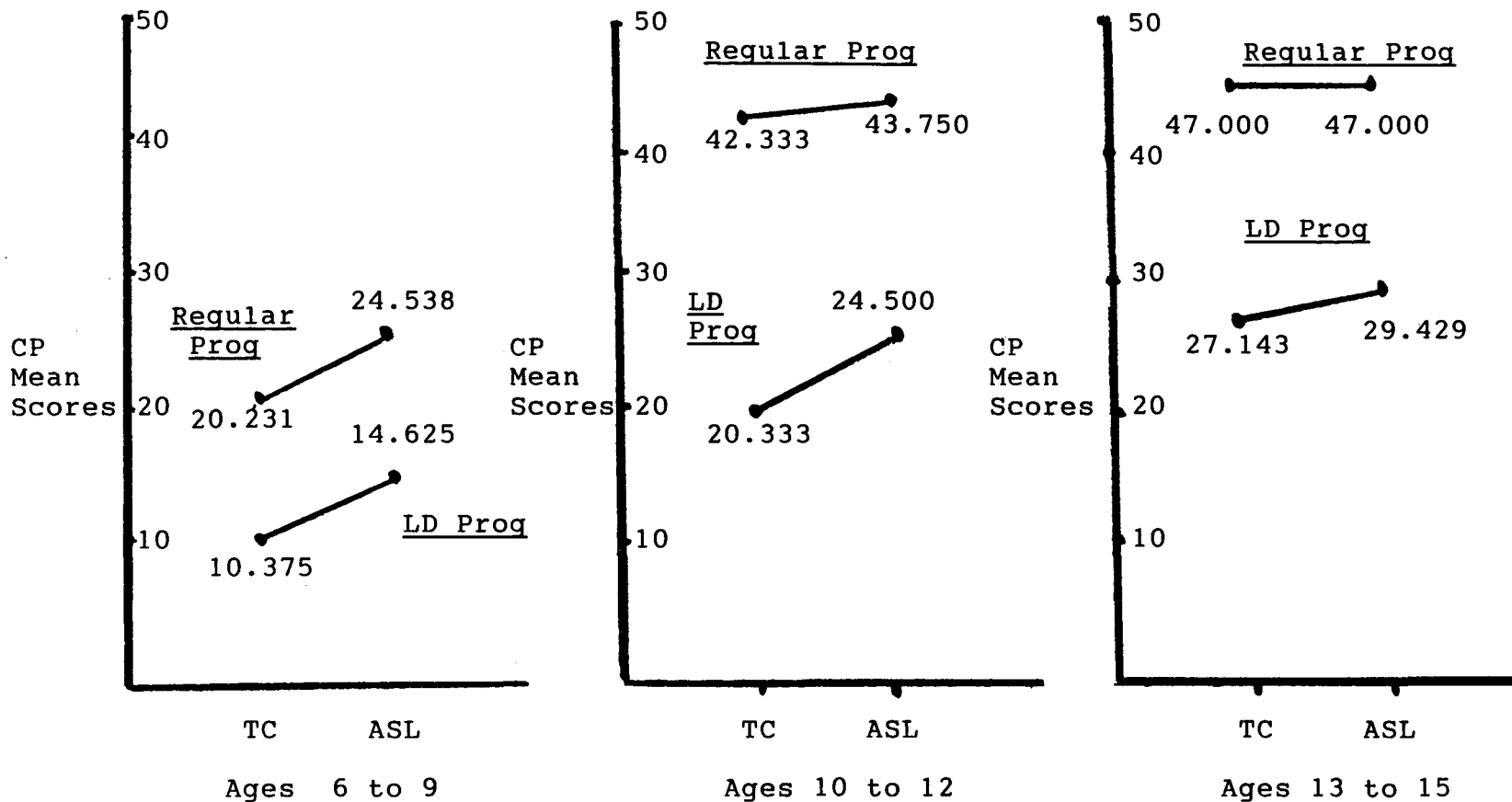


Fig. 6 A comparison of mean scores on the Comprehension Passages (CP), illustrating the Sign Language Methods by Age Levels by Learner Types interaction

Since a large number of children in the sample came from non-English speaking families, it was felt important to test for the possible influence of this variable (family language type--English-speaking, non-English speaking) as well. However, inclusion of a fourth variable in one ANOVA would have reduced the number of subjects in some of the cells to unacceptably low levels. Hence, the variable "learner types" was dropped from the original analytic paradigm, "family language types" added, and a second 2 (sign language methods) by 2 (family language types) by 3 (age levels) ANOVA for repeated measures (ANOVA #2) was computed.

Analysis of the data set again revealed a significant main effect for age levels ($p < .001$), and a non-significant main effect for sign language methods. No significant main effect was noted for family language types. The two-way interaction of sign language methods and family language types, and the three-way interaction of sign language methods by age levels by family language types were not found to be significant. The findings of ANOVA #2 are summarized in Table 4.

Table 4.--Results of Multivariate Tests, ANOVA #2

Source of Variance	Df	F	p
Sign Language Methods	1	2.99	.09
Age Levels	2	9.66	.000*
Family Language Types	1	1.22	.27
Sign Language Methods by Age Levels	2	5.13	.01
Sign Language Methods by Family Language Types	1	.19	.67
Sign Language Methods by Age Levels by Family Language Types	2	1.16	.32

* $p < .001$

Conclusions

Based on the findings reported above, the following conclusions can be made:

1. The main treatment effect for sign language methods was not found to be significant. Null hypothesis #1 could not be rejected.

2. Significant differences were found across age levels of children completing the Immediate Recall Passages, Delayed Recall Passages, and Comprehension Passages. In general, the older the child, the higher the

score obtained. Therefore, null hypothesis #2 was rejected.

3. Children in the regular deaf program obtained significantly higher scores on the Immediate Recall Passages, Delayed Recall Passages, and Comprehension Passages than learning disabled deaf children. Therefore, null hypothesis #3 was rejected.

4. There were no significant differences on the Immediate Recall Passages, Delayed Recall Passages, and Comprehension Passages between children from English-speaking and non-English speaking families. Therefore, null hypothesis #4 could not be rejected.

5. In regard to memory and comprehension, the findings reported here suggest that presentation in Ameslan had a significant advantage over total communication, at least for subjects in the 6 to 12 year age range. Children in the youngest group (ages 6 to 9) scored higher on Immediate Recall Passages, Delayed Recall Passages, and the Comprehension Passages when they were presented in Ameslan. Children in the middle age group (ages 10 to 12) scored higher on the Immediate Recall Passages and Delayed Recall Passages, when they were presented in Ameslan. Given these findings, null hypothesis #5 was rejected.

6. Overall, use of Ameslan was found to be no more

of an advantage for children in the regular deaf program or deaf children with learning disabilities. Therefore, null hypothesis #6 could not be rejected.

7. Overall, use of Ameslan was found to be no more of an advantage for children from English-speaking or non-English speaking families. Therefore, null hypothesis #7 could not be rejected.

8. Overall, use of Ameslan was found to be no more of an advantage for children in the regular deaf program or deaf children with learning disabilities. However, when age level was taken into account, the youngest children (ages 6 to 9) in the regular deaf program benefited more from use of Ameslan than the youngest children (ages 6 to 9) in the deaf learning disabled group. Therefore, null hypothesis #8 was rejected.

9. Use of Ameslan was found to be no more of an advantage for children from English-speaking or non-English speaking families, regardless of age level. Therefore, null hypothesis #9 could not be rejected.

CHAPTER V

DISCUSSION

Integration of the Findings Related to Testing the Null Hypotheses

In the present study, children at the youngest age levels (ages 6 to 9) scored significantly higher on Immediate Recall Passages, Delayed Recall Passages, and Comprehension Passages, when these passages were presented in Ameslan. Children at the middle age levels (ages 10 to 12) scored significantly higher on the Immediate Recall Passages and the Delayed Recall Passages when Ameslan was used, though their Comprehension Passages scores were not significantly different from those obtained using total communication. When passages were signed to children in the oldest group (ages 13 to 15), no significant differences were found between Ameslan and total communication on any of the dependent measures. Thus, while the main treatment effect for sign language methods was not found to be significant (a finding related to testing null hypothesis #1), the results reported here indicate that the use of Ameslan can facilitate short-term recall, long-term recall, and comprehension of information in deaf children in the early and middle years of elementary

school (a finding related to testing null hypothesis #5).

It should be noted that the findings reported here are in contradiction with those reported by Eagney (1987), but are in general agreement with those reported by Livingston (1986). Eagney did not investigate the relationship of sign language methods and memory, but did compare three sign language methods and resultant message comprehension. In her study, no differences in comprehension were found when Ameslan was used, and no interactions between age and sign language type were noted. While Livingston found no differences when signed directions were relatively short or grammatically simple, she did find that with longer or grammatically complex directions, the subjects understood Ameslan better. The study described by Livingston did not include age as a variable in the analysis, but the issue of communication length and complexity might have some relevance to the present findings, as one attempts to explain why the younger children comprehended and remembered more from Ameslan presentation, when the oldest children did not.

According to previous evaluations by a school speech/language therapist, a majority of the youngest children in the present study had signed English receptive vocabulary and syntax skills at the preschool level. Consequently, one might assume that even the simplest of the

story passages presented some challenge to the receptive language processing and memory of a number of children in the 6 to 9 year old group (all of Livingston's selections but one were single-sentence directions, including those labeled "long" or "complex"). If, as Livingston suggests, Ameslan has an advantage when the message is long or complex for the receiver, the use of Ameslan may have served as an additional aid for children who were just beginning to establish a language base.

For the children in the 10 to 12 year old age group, the use of Ameslan appeared to facilitate short- and long-term recall, whereas story comprehension was found to be similar for passages signed in Ameslan and total communication. To speculate on differences here, one might compare the Comprehension Passages with the Immediate Recall Passages and Delayed Recall Passages in terms of what was required of the subject. On the Comprehension Passages, the child was asked a question about the content of a story just viewed. The child had to understand the story to get a correct answer, but some images of the content were given by the nature of the question itself. On the memory measures, the child had to generate all story images --there was no leading question to set the context of the response. School language evaluations indicated that youngsters in the middle age group had developed receptive

signed English vocabulary and grammatical skills to at least the early primary grade level. This may have given them sufficient ability to determine the correct one- or two-word answers to the highly-structured Comprehension Passages questions--equal to what they could derive from Ameslan. Nevertheless, when it came to encoding in short- or long-term memory, the task may have been long enough or complex enough that the shorter sentence structure, unimodal presentation style, or greater visual/spatial imagery of Ameslan gave it an advantage.

The oldest children, while still manifesting notable language delays when compared with hearing peers, had arrived at a point where most could process signed English vocabulary and grammar at a primary to middle grade level (again, based on school language evaluations). It appears that by this time they may have gained enough competency and educational experience with signed English that the comparative benefits of Ameslan were reduced. At this age, memory scores as well as comprehension scores were found to be similar for Ameslan and total communication presentation.

The data reported here seems to suggest that Ameslan was most useful to children whose receptive signed English skills were at earlier stages of development--that as children gained a more established base in English, the rela-

tive advantages of Ameslan in facilitating information processing diminished. However, this statement must be viewed with caution. The statistical analyses of the data set indicated that the Immediate Recall Passages, Delayed Recall Passages, and Comprehension Passages were reasonably discriminative with regard to age and learner type (i.e., older subjects obtained significantly higher scores than younger subjects, regular deaf program subjects obtained significantly higher scores than learning disabled deaf subjects). These findings are related to testing null hypotheses #2 and #3. Also, a consistent pattern was seen on all three dependent measures. Still, it is possible that the series of passages was not uniformly difficult for all age groups--that passages did not have a high enough ceiling for some of the older subjects. Examination of mean scores of the sign language methods by age levels interaction (see Chapter IV, Table 2) and the sign language methods by age levels by learner types interaction (see Chapter IV, Table 3) reveals that, particularly for subjects in the regular program, middle age group means were much closer to the means of the oldest group than to the means obtained by the youngest group. If Ameslan truly has an advantage over total communication when presented language structures are long or complex, differences between the sign language forms may not have been adequately

tested for certain children at the upper age levels. The only clear resolution of this issue will be replication of the research using other evaluation instruments.

An additional significant interaction of sign language methods by age levels by learner types was found, indicating that children in the youngest group who were in the regular deaf program benefited more from Ameslan presentation than children with additional learning disabilities (a finding related to testing null hypothesis #8). It should be noted that overall, children in the regular deaf program did not benefit more from the use of Ameslan than children in the learning disabilities group (a finding related to testing null hypothesis #6). This would at first seem to contradict the above speculation that children at the lowest language levels benefited more from presentation in Ameslan, since the youngest learning disabilities children had the poorest language skills of all the youngsters in the study. However, one must remember that children are not considered eligible for learning disabilities simply because their language is delayed. Learning disabilities placement requires documentation of at least average intellectual abilities, but with delays in such areas as attention, perception, memory, association, or visual-motor coordination which interfere significantly with academic achievement. Thus, while Ameslan usage may have

been especially helpful to children at the lower language levels, the combination at this age of severe language delays with additional learning/processing problems could have nullified any advantage a particular sign language method would have had.

Another variable examined in the present study was family language types. Eighteen of the subjects came from non-English speaking families, and it was felt that differences in how family members spoke to children (e.g., cultivated a lipreading knowledge of a language other than English) or signed to children (e.g., parents may have had reduced facility in signed English/total communication) could have had some influence on how children responded to research tasks. However, findings indicated no differences in scoring on the dependent measures between children from English-speaking and non-English speaking families (a finding related to testing null hypothesis #4), no differences between groups with regard to how they processed passages in Ameslan and total communication (a finding related to testing null hypothesis #7), and no interaction effect by age group (a finding related to testing null hypothesis #9).

Applications to the Field

As was described earlier, a growing number of per-

sons have criticized current methods of deaf education, charging that curricular material is not be presented in a form which is truly accessible to most deaf children. Given the problems uncovered in the usage of spoken and manual English, a segment of educators has begun to actively promote instruction in Ameslan. So far, discussion comparing English (as presented via total communication) and Ameslan has involved ease and completeness of early symbol system acquisition, and the ability of each language approach to promote conversational, reading, and writing skills. The research reported here was an attempt to broaden the discussion somewhat, to address the relative capacity of each of these languages to facilitate information processing. If it could be documented that Ameslan was easier for deaf children to comprehend and remember, it would add to the body of knowledge necessary in determining if Ameslan should be implemented in the classroom or total communication retained.

The present findings do indicate that Ameslan is easier for deaf children to comprehend and remember, at least for children in the primary and middle grades. What is of further interest here is that such results were obtained in a group of youngsters who had been taught using total communication, and who had no previous formal training in Ameslan. These findings have several impli-

cations with regard to current practices in the field.

As has been previously noted, Ameslan use in the classroom was traditionally frowned upon by educators of the deaf. Most youngsters gradually acquired Ameslan via social contacts with other deaf persons, typically during the adolescent years. When Ameslan has appeared in the classroom, it has usually been utilized with older students. Present findings suggest that there may be some educational advantages in using Ameslan, and that these advantages may be relatively greater for the younger students. This provides some rationale for exposing primary and middle grade students to Ameslan, and lends some support for those such as Johnson et al. (1989) who are advocating early immersion in Ameslan environments. The fact that subjects performed better using Ameslan, even though their language background was in total communication, also raises speculation on how much better the children might have done on comprehension or memory tasks if they had been taught using Ameslan from an early age.

Another implication of the present findings has to do with what is known as the Regular Education Initiative (Heward & Orlansky, 1992). There has been a recent trend in special education to follow this line of thinking, which states that disabled children, including children with severe disabilities, have a right to be taught within

a regular school program. With regard to the deaf, some school districts have begun moving students from residential and day school programs for the hearing-impaired, and placing them in their neighborhood schools with interpreters (Moores, 1991). In the past, it had been argued strongly that deaf children needed highly specialized speech/language training, a small classroom setting, and the opportunity for contact with a deaf peer group (e.g., Brill, 1975). If there is reason to believe that Ameslan use would have educational value for the deaf, this would be an additional item to consider before automatically placing a child in a regular classroom. Ameslan cannot be interpreted directly from English, and there would be no group available with whom to use the language interactively.

A third implication of the findings relates to teachers who are deaf. In the past, deaf instructors were often limited to teaching older or slower deaf children (Moores, 1978). This was done because it was believed that they might have a negative influence on the development of students' speech and language skills. If evidence continues to accumulate that Ameslan has a place in educational settings, this should open the door for deaf adults to be more involved in the instruction of young deaf children.

Implications for Future Research

The results of the present study indicate that Ameslan can facilitate information processing in certain groups of deaf children. Much more research is necessary, however, before one can say that overall, Ameslan is a better method for teaching deaf children than total communication.

The research reported here is limited in several respects, and requires follow-up study for clarification of findings. First, the subjects were all from low-income or blue collar families, and the majority came from racial or ethnic minority groups. While all the deaf share a common sensory/language disability, one must still be cautious about generalizing findings to other groups in the population. Second, there may be differences in the types of information that use of Ameslan can enhance. This was touched upon when the issue of message complexity was raised by Livingston (1986). If Livingston's findings were confirmed by additional research, messages or reading passages that consisted of "difficult" or "complex" English might be made available to students in both English and Ameslan. Along this line, Hanson and Padden (1989) experimented with an interactive computer video program, which can present Ameslan-signed translations of English reading selections. Furthermore, there are other ways of categorizing information which might help in analyzing the

effectiveness of Ameslan. For example, Ameslan could have a clear educational advantage when telling stories, or teaching history or science, but make little difference in comprehension or memory when teaching mathematics. A third area that requires research follow-up and confirmation involves the present research finding that the use of Ameslan has a greater effect with younger children.

Beyond the scope of the research reported here, other issues must be resolved before Ameslan is implemented in the schools. Advocacy for Ameslan has become a political issue, in the sense that Ameslan is a major symbol of deaf pride and culture. Socio-political arguments have to be kept separate from educational planning, however. For example, persons have argued that Ameslan be taught first, and that after a language base is established, English can be taught as a second language. Still, the advocates of this approach tend to be vague or to avoid discussion altogether about how the deaf child will be taught and acquire this second language (Stuckless, 1991). Research questions must also be posed regarding the implications early immersion in an Ameslan signing environment has for learning to read and write. These issues must all be empirically addressed, before final recommendations can be made.

APPENDIX A

Immediate Recall Passages, Form A

1. Tom

Tom had a red ball. He threw it. His dog ran and caught it. Tom laughed.

2. Jack's Knife

One day Jack found a knife on the sidewalk. He played with it. He cut his finger. He cried.

Jack's mother put a bandaid on his finger. She said, "Never, never play with a knife!"

3. The Hungry Kitten

One cold night a little black kitten came to Jane's house. It sat on the doorstep and cried.

Jane heard it. She opened the door. The kitten ran into the house and under the table. It was hungry.

Jane's mother gave it some milk. It drank the milk and then it went to sleep.

4. The Balloon

Last Fourth of July there was a big parade. Harold's father took him to see it. They stood on the sidewalk and watched it for a long time. Many soldiers marched past.

Several bands played.

A man with some balloons came along and Harold's father bought him a red one. Harold held it fast by the string. After a while the string broke and the balloon went high up in the sky. Harold began to cry. He wanted his father to buy him a balloon but they could not find any.

5. The Quarrel

Herman and George lived on the same block. They were great friends, but sometimes they quarreled.

One afternoon Herman said to some of the boys, "Let's play baseball. I'm the captain." George wanted to be captain too. They began to quarrel. George was very angry. He went home and sat on his doorstep alone. The other boys had a fine time.

Pretty soon George began to feel lonesome and ashamed. Herman began to feel sorry too. After a while, all the boys marched down the street and stopped in front of George's house. Herman said, "Come and play with us."

George smiled and said, "All right." Both boys were glad to be friends again.

Immediate Recall Passages, Form B

1. The Cat and the Milk

Yesterday a woman went to a store. She bought some milk. She put it on the table. The cat jumped on the table and drank the milk.

2. The Snow Storm

One night it snowed very hard. The snow was deep. In the morning, Erin put on her warm jacket, hat, and gloves. She went outdoors. Two children pulled her on her sled. They ran fast and Erin fell off. She was not hurt.

3. The Rabbits

David had two little rabbits. One was white and the other was gray. They had long ears and short tails.

David's father made a little house for the rabbits and put it in the yard. He painted it green.

The rabbits lived in the house for a long time. David fed them every day. They grew large and fat.

4. Katie's Lunch

One morning Katie rode to school with her mother. She forgot her lunch. She left it on the seat in the car.

Pretty soon it was time to eat lunch. She was hungry. She had no lunch.

Frances felt sorry for her. She gave her a sandwich and an apple. Katie was happy. She said, "Thank you."

5. Philip's Pumpkins

Last spring Philip's teacher gave him a handful of seeds. His father helped him plant them in the back yard. In about a week some little plants came up. Philip watered them and took good care of them. They grew to be fine, large vines.

One morning Philip saw three little green balls on the vines. He called his mother to look at them. "They are little pumpkins." she said.

In the fall, Philip had three large yellow pumpkins. One Saturday, he made a Jack-o'-lantern of one of them. That evening, he took it out on the street. He met several people. One man pretended to be afraid. He ran and hid behind a tree.

APPENDIX B

Delayed Recall Passages

Form A: The Lost Children

One day in summer a rather small boy and a very small girl saw a beautiful butterfly. They chased it and tried to catch it. They ran on and on. At last they were very tired. They wanted to go home, but they did not know the way. They were lost. It grew dark and the little girl began to cry. The boy tried to carry her, but she was too heavy. They sat down on the ground.

Soon a truck came down the road. The driver knew the children. He lifted them into the truck and took them home.

Form B: The Hungry Mouse

A little mouse was hungry one night. It ran out of its house. It jumped on the table and found some cheese.

Later, a cat saw the mouse and chased it. It ran behind a box and the cat did not catch it.

APPENDIX C

Comprehension Passages, Form A

1. The Squirrel

One Sunday, Jim and Amy went to the park. They sat on a bench and ate some nuts.

Soon, a little gray squirrel came and looked at them. Amy threw a nut on the ground. The squirrel took it in its mouth and ran up a tree.

Questions:

1. How many children are in the story?
2. Where did Jim and Amy go?
3. What came and looked at them?
4. What color was the squirrel?
5. What did Amy throw on the ground?
6. Where did the squirrel run?

2. The Snake

Last summer, Frank and Henry were in the garden. A big snake crawled out of a hole. The boys saw it.

Henry was afraid. He ran and hid behind a tree. Frank was very brave. He went closer to see where the snake would go.

Questions:

1. How many boys were in the garden?
2. What crawled out of a hole?
3. Who was afraid?

4. Where did he hide?
5. What did Frank do?

3. The Crow's Nest

One day a boy saw a crow's nest in a tall tree. He climbed the tree and took one of the eggs out of the nest. The mother crow was very angry. She flew around him and cawed loudly. Several other crows heard her. They flew around him too, and made a great noise. The boy was frightened. He left the rest of the eggs in the nest, climbed down, and ran away.

Questions:

1. Where was the crow's nest?
2. Who saw it?
3. How many eggs did he take?
4. What did the mother crow do?
5. What did the other crows do?
6. How did the boy feel?
7. What did he do?

4. The Fire

Mr. Jackson owned a store. Every night he left his dog Buster in the store to take care of it. Buster slept on the floor.

One night some papers caught fire. Buster smelled the smoke and began to bark. A policeman heard him barking and came to see what was wrong. He broke open the door and threw a pail of water on the fire, but he couldn't put it out. He ran to the corner and called the fire de-

partment. In a few minutes, fire trucks came and the firemen put out the fire.

Questions:

1. What happened in Mr. Jackson's store one night?
2. How did the policeman know about the fire?
3. How did Buster know about the fire?
4. How did the policeman get into the store?
5. How did he try to put out the fire?
6. What did he do when he couldn't put it out?

5. The Earthquake

It was very early in the morning and Mizu-San was fast asleep. She lay on a mat on the floor and under her head was a hard wooden pillow. But she was comfortable, for Mizu-San was a little Japanese girl and in Japan everybody sleeps on mats on the floor and everyone uses wooden pillows.

Suddenly, Mizu-San awoke with a start, because the whole house was shaking. It shook a little at first and then more and more. In a minute, everyone was awake and dressing hurriedly. Mizu-San could hear people running in the street and calling, "Earthquake! Earthquake!"

Her mother began rolling up the bed mats, and carrying them out. Soon, all the family were gathered in the garden behind the house. Again and again the earth shook. The walls of the house fell in and the roof came crashing down. Everyone was happy that no one had been hurt. Nearly all the houses on the street had fallen. In some

places, fires had started.

Mizu-San clung to her mother as they sat with other women and children in an open space in the garden. As she looked around at the ruined houses, the fires, and the terrified people, she thought it must be the end of the world.

Questions:

1. What do Japanese people sleep on?
2. Why did Mizu-San awake suddenly?
3. Where did the family gather?
4. Was anybody hurt when the house fell?
5. How did the people feel?
6. What did Mizu-San see as she looked around?
7. What were the people in the street calling?

Comprehension Passages, Form B

1. Helen and the Baby

Last week Helen and her baby brother sat on the floor. She rolled a yellow ball to him. He didn't catch it. He laughed and clapped his hands.

Questions:

1. Who sat on the floor?
2. What did Helen roll to her brother?
3. What color was the ball?
4. Did the baby catch it?
5. What did he do?

2. The Picnic

Last summer Alfred and his big brother went to the pond to have a picnic. They carried their lunch with them.

Alfred's brother caught three fish. He made a fire and cooked them. Then the boys sat under a tree and ate.

Questions:

1. Where did Alfred go?
2. Who went with him?
3. What did his brother cook?
4. Where did the boys sit?
5. How many fish did Alfred's brother catch?

3. The Cat and the Bird

One day a bird sat in a tree and looked around. It wanted something to eat. It saw a piece of bread on the ground. It flew down and began to eat it.

An old black cat saw the bird and crept up behind it. The cat almost caught it, but the bird heard the cat

and flew back into the tree.

The cat was disappointed. It lay down on the steps and went to sleep. Then the bird flew down again and ate the bread.

Questions:

1. Where was the bird sitting?
2. What did the bird see?
3. What tried to catch the bird?
4. When the cat didn't catch the bird, what did it do?
5. When the cat went to sleep, what did the bird do?

4. Tammy's Skates

Last spring Tammy said to her mother, "Please buy me a pair of roller skates." Her mother did not buy the skates, but she gave Tammy a little bank and told her to save the money.

For two months Tammy saved all her money. Then she opened the bank and counted the change. Tammy was disappointed because she did not have enough. That night her mother gave her the extra money she needed.

The next day Tammy bought the skates. She didn't know how to skate, and she fell down many times. The other children laughed at her, but she didn't care. In a few days she learned to skate very well.

Questions:

1. What did Tammy's mother give her?
2. Did Tammy save all the money she needed?
3. Why was Tammy disappointed?

4. What did her mother do?
5. Did Tammy know how to skate?

5. The Rainbow

One warm afternoon in summer there was a thunder shower. It rained very hard for a few minutes and then the sun came out.

Jerry looked out of the window and saw a beautiful rainbow. His older brother saw it too. He told Jerry there was a bag of gold at the end of the rainbow.

Jerry thought, "I am going to get that bag of gold." He took his cap and crept out of the house. He ran down the street and across the field, but he did not come to the end of the rainbow. It was far, far away. He ran on and on. He was tired and out of breath, but he did not stop running. Finally, he slipped and fell. He got up and looked for the rainbow, but it was gone. He sat on a large rock and cried.

Questions:

1. What did Jerry see?
2. Who else saw it?
3. What did Jerry's brother say about the rainbow?
4. What did Jerry want?
5. Where did he run?
6. Did he find the bag of gold?
7. What happened to him while he was running?

APPENDIX D

Descriptive Statistics

Sign Language Methods by Age Levels Interaction

Immediate Recall Passages, Ameslan

	Mean	S.D.	N
Youngest	23.095	10.358	21
Middle	31.889	12.024	18
Oldest	30.067	12.209	15

Immediate Recall Passages, Total Communication

	Mean	S.D.	N
Youngest	16.810	11.205	21
Middle	27.556	14.686	18
Oldest	30.600	14.096	15

Delayed Recall Passages, Ameslan

	Mean	S.D.	N
Youngest	10.000	7.021	21
Middle	13.778	4.427	18
Oldest	18.800	7.618	15

Delayed Recall Passages, Total Communication

	Mean	S.D.	N
Youngest	4.905	3.986	21
Middle	8.889	5.324	18
Oldest	15.133	8.391	15

Comprehension Passages, Ameslan

	Mean	S.D.	N
Youngest	20.762	8.203	21
Middle	37.333	12.709	18
Oldest	38.800	13.251	15

Comprehension Passages, Total Communication

	Mean	S.D.	N
Youngest	16.476	8.400	21
Middle	35.000	14.109	18
Oldest	37.733	14.704	15

Sign Language Methods by Age Levels by Learner Types Interaction

Immediate Recall Passages, Ameslan

	Mean	S.D.	N
Regular:			
Youngest	28.615	9.124	13
Middle	35.750	12.772	12
Oldest	37.875	8.543	8
L.D.:			
Youngest	14.125	3.907	8
Middle	24.167	5.037	6
Oldest	21.143	9.406	7

Immediate Recall Passages, Total Communication

	Mean	S.D.	N
Regular:			
Youngest	21.769	11.285	13
Middle	31.833	16.163	12
Oldest	38.875	9.920	8
L.D.:			
Youngest	8.750	4.528	8
Middle	19.000	5.177	6
Oldest	21.143	12.375	7

Delayed Recall Passages, Ameslan

	Mean	S.D.	N
Regular:			
Youngest	12.462	7.090	13
Middle	15.167	3.713	12
Oldest	20.750	5.726	8
L.D.:			
Youngest	6.000	5.014	8
Middle	11.000	4.733	6
Oldest	16.571	9.289	7

Delayed Recall Passages, Total Communication

	Mean	S.D.	N
Regular:			
Youngest	6.000	3.958	13
Middle	10.750	5.396	12
Oldest	18.000	7.653	8
L.D.:			
Youngest	3.125	3.563	8
Middle	5.167	2.714	6
Oldest	11.857	8.513	7

Comprehension Passages, Ameslan

	Mean	S.D.	N
Regular:			
Youngest	24.538	7.055	13
Middle	43.750	9.117	12
Oldest	47.000	10.170	8
L.D.			
Youngest	14.625	6.116	8
Middle	24.500	8.361	6
Oldest	29.429	9.846	7

Comprehension Passages, Total Communication

	Mean	S.D.	N
Regular:			
Youngest	20.231	8.248	13
Middle	42.333	10.325	12
Oldest	47.000	10.889	8

Comprehension Passages, Total Communication

	Mean	S.D.	N
L.D.:			
Youngest	10.375	4.033	8
Middle	20.333	7.421	6
Oldest	27.143	10.991	7

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The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been made. The dissertation is now given final approval by the committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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