THE EFFECTS OF TOTAL, COMMUNICATION, MANUAL COMMUNICATION, ORAL COMMUNICATION AND READING ON THE LEARNING OF FACTUAL INFORMATION IN RESIDENTIAL SCHOOL DEAF CHILDREN

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
ALFRED HENRY WHITE, JR.
1972

This is to certify that the

thesis entitled

The Effects of Total Communication, Manual Communication, Oral Communication and Reading on the Learning of Factual Information in Residential School Deaf Children

presented by

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has been accepted towards fulfillment of the requirements for

Ph.D. degree in Education

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Date May 17, 1972

ABSTRACT

THE EFFECTS OF TOTAL COMMUNICATION, MANUAL COMMUNICATION, ORAL COMMUNICATION AND READING ON THE LEARNING OF FACTUAL INFORMATION IN RESIDENTIAL SCHOOL DEAF STUDENTS

by

Alfred H. White, Jr.

The polemic between proponents of oral and combined methods of communication for deaf children has been an active controversy for many years and it is not likely that it will be resolved very soon.

The issue cannot be overlooked because it holds a central place in the philosophy of deaf education. Rather than trying to ignore the controversy, or trying to make ubiquitous claims regarding what is best for all deaf children, this study attempted to focus upon two populations of hearing impaired children at two different residential schools, and discover the method of communication under which those students assimilate more factual information.

A stratified random sample of 45 Ss was drawn from the Maryland School for the Deaf. Ss ranged in age from 11.0 to 18.7 years and in IQ from 60 to 140. These Ss were presented factual information through four methods of communication: (1) oral communication, (2) total communication, (3) manual communication, and (4) reading. The independent variables in the study were; method of

communication, age, and intelligence. The dependent variable was the amount of information assimilated.

It was hypothesized that hearing impaired children would assimilate more factual information when it was presented to them through total communication, manual communication and reading than they would through oral communication. It was hypothesized that there would be an interaction between method of communication and intelligence; the lower IQ Ss being able to assimilate more through manual communication (speech deleted) and the average and bright Ss being able to assimilate more through total communication. It was also hypothesized that hearing impaired children would assimilate more information through reading than they would through oral, total, or manual communication.

An experimental design was used to eliminate criticism directed against the use of ex post facto designs which employ matching techniques. A 3 x 3 x 4 factorial repeated measures design, fixed effects model was used. Ss were presented four passages of factual information through each of the four methods of communication; each S was compared to himself across the four methods of communication. The use of a repeated measures design eliminated the need to match or randomly assign heterogeneous Ss to

treatment groups. Four different passages were used with each of the four methods of communication; two of the four passages were at the 2nd grade level of difficulty, and two were at the 4th grade level. Equivalent passages were randomly assigned for use with the four methods of communication.

The same certified interpreter for the deaf was employed to present the material to all Ss under all methods of communication. Information was presented over a three day period, at three different periods each day. "Time of day", "day", and "order of presentation" were eliminated as confounding variables through systematic scheduling.

The results of the analysis of the data suggest the following conclusions: (1) hearing impaired children assimilate more factual information through reading than they do through oral or total communication; (2) hearing impaired children assimilate more factual information through total and manual communication than they do through oral communication; (3) all categorical sub-groups of hearing impaired children assimilate more information through total communication and manual communication than they do through oral communication; (4) the speech component in total communication does not increase the amount of information assimilated over that assimilated

through pure-manual communication; (5) bright, average and low functioning hearing impaired children do not differ in their ability to assimilate information through oral communication; however, average and bright children do significantly better than low functioning children through total communication, manual communication and reading.

A replication of the Maryland study was conducted at the Michigan School for the Deaf. In general, the results of the replication supported the findings of the Maryland study.

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Special Education

1972

ACKNOWLEDGMENTS

The author would like to take this opportunity to express sincere appreciation to several people for their meaningful and timely contributions to this endeavor. To Dr. Edwin J. Keller, chairman, appreciation must be expressed for the many hours he has spent in guidance throughout the author's doctoral program; as a person, sensitive to the needs of others, and as a scholar of unique acumen, Dr. Keller is most worthy of commendation.

The author's gratitude is also extended to Mrs. Vivian Stevenson, Dr. Mary Ellen McSweeney, and Dr. Julia Falk for their sensitivity, meaningful suggestions and general interest during his association with them, and particularly during the completion of this work.

Deep appreciation is also expressed to the administrators and staff at the Maryland and Michigan Schools for the Deaf. Without their cooperation this study would have been impossible.

Finally, my parents, children and dear wife, Susanne, must be thanked for their continual support. Each has been a unique source of strength in encouraging the completion of graduate studies and this dissertation; without their unselfishness and sacrifices, efforts to complete this work would have been futile.

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CHAPTER I

THE PROBLEM

Historically, one of the crucial problems in the education of deaf children has been the inability of professionals to resolve the oral-manual controversy. Until the last few years proponents of both oral and manual methods of communication have been inclined to defend the efficacy of their preferred methods rhetorically rather than empirically. Advocates of the oral method still argue that exposing deaf children to any form of manual communication will reduce their ability to speechread and speak, consequently resulting in greater estrangement from the mainstream of society. Proponents of manual methods continue to denounce these assertions arguing that there is no evidence to support such propositions and that the use of signs and fingerspelling is necessary if deaf children are to achieve their maximum potential and live full, rich lives.

During the past decade proponents of various manual methods have begun to generate a body of research which supports their claim that general educational achievement is enhanced through the combined use of speech, fingerspelling and signs. The result has been a dramatic change in deaf education. Many oral advocates have re-examined their philosophy in light of this research and thus

modified their philosophical position to incorporate signs and fingerspelling. In short, there has been a marked philosophical shift from the use of oral-only methods to the use of various manual methods. This shift has precipitated several questions: (1) What are the proposed advantages of manual methods? (2) For whom are manual methods more effective? (3) How does total communication which encourages the use of all avenues of communication compare to oral-only communication in conveying factual information? (4) Can students assimilate more factual information through total communication than they can through a "pure-manual" mode of communication?

Purpose of this Study

The trend towards the use of total communication is supported by the general concept that deaf children receive "a little information" through residual hearing, "a little information" through speechreading and a "lot of information" through signs and fingerspelling. It is often implied by proponents of total communication that deletion of any of these components from the communication process results in a loss of information. If this proposition is true, then there is another powerful reason for educators to speak while communicating manually in addition to the traditional one which asserts that failure to speak deprives the deaf child of critical speachreading

practice. Informed persons, familiar with practices at most residential schools, recognize that all teachers are encouraged to use speech; however, careful observation of teachers' practices frequently reveals that many teachers fail to use speech when communicating manually with children. In this study, the question is being asked: Does a teacher who fails to speak while communicating manually deprive children of information which they would otherwise receive?

Thus, a major purpose of this research is to investigate the contribution of speech in the assimilation of factual information when that information is presented through total communication.

Although a trend towards total communication exists, many respected oral educators have not been persuaded to alter their philosophy despite the results of current research (Miller, 1970; Fellendorf, 1970; Bruce, 1969). They have criticized the research supporting the use of manual methods on several counts. It is argued that: (1) a majority of the studies have employed ex post facto designs which do not allow control of independent variables; (2) most studies have employed matching techniques to achieve random equivalence of experimental and control groups, but such a technique does not control for differential regression or for innumerable determinants beyond those few upon which the groups were matched; and (3) few,

if any, of the studies have been conducted at schools where contamination of subjects by fingerspelling and signs was not a factor.

Although most professionals in deaf education are weary of the polemic between proponents of oral and various manual methods, the issue cannot be dropped since it holds a nuclear position in the educational process. Hence, another primary purpose of this study is to investigate the effects of four methods of communication in the assimilation of factual information: namely, oral communication, total communication, manual communication and reading. This study attempts to improve upon previous studies comparing methods of communication by using an experimental design rather than an ex post facto one, and by allowing students to act as their own control thus eliminating the need for matching.

Many general educators as well as educators of the deaf have stressed the need to formulate teaching strategies based upon the unique needs of children. However, little attention has been directed to assessing the effects of various modes of communication with different kinds of deaf children. It is important that research be conducted which focuses upon categorical sub-groups nested under the rubic of deafness and which evaluates how they learn--assimilate information--when exposed to various methods of communication. It is conceivable that a method highly

effective with bright deaf children, for example, may be very ineffective with retarded or lower functioning deaf children. This study proposes to evaluate the ability of bright, average and low functioning hearing impaired children to assimilate factual information under different modes of input.

In summary, there are three purposes for this study. First, an attempt is made to assess the relative contribution of speech in transferring factual information from "teacher" to "student" using total communication. Second, the study investigates the ability of different categorical sub-groups of hearing impaired children to assimilate factual information under different modes of input. And finally, the comparisons between methods of communication were made utilizing an experimental rather than an ex post facto design.

Definition of Terms

The terms; "oral method", "Rochester method", "simultaneous method", "sign language", "Signed English" and "total communication" are understood by most professionals in the area of deaf education. However, to eliminate any ambiquity which may exist certain standard definitions accepted in the field will be cited. These definitions served as a framework for the formulation of more explicit definitions used within this study.

In schools for the deaf in the United States basically three methods of communication are used:

> The Oral Method. In this method, as practiced in its pure form, the deaf child is instructed through speech and writing. He, in turn, communicates through speech, speechreading, writing and reading. This method also is known as the German Method because of its original widespread use in Germany through the work of Samuel Heinicke in the 18th century (Quigley, 1967; p.3).

> The Rochester Method. This method also uses speech, speechreading, writing, and reading as a means of communication between students and instructor but adds fingerspelling as an additional communication avenue (Quigley, 1967; p.3).

> The Simultaneous Method. In the Simultaneous Method, communication and instruction are conducted in the same manner as in the Rochester Method with the addition of manual signs. This method also is known as the French Method due to its original use in France through the work of the Abbe Charles Michel de l'Epee in the 18th century (Quigley, 1967; p. 3).

Auditory training and amplification are used in varying degrees in all three methods, usually with greatest emphasis associated with the oral method.

> American Sign Language. Sign Language is a language in which what are commonly called gestures do the usual work of words, or more precisely, in which cheremes are found instead of phonemes. But, most important, it is also a language that has its own morphology, syntax, and semantics (Stokoe, 1970; p. 5).

Signed English. What most hearing observers see when watching an interpreter or teacher of the deaf is not Sign Language, but rather Signed English. Stokoe says:

> This--Signed English--is a rapid succession of glossing the content words of an English utterance more or less approximately and glossing some function

> words, but not all. It usually includes fingerspelled words as well as signs. Both the signer and the addressee in this mode must know English well, because the signs are put together as if they were English words and not by the rules of Sign Language syntax (1970, p. 5-8).

Total Communication. Total communication has probably best been defined by Denton:

> By total communication is meant the right of a deaf child to learn to use all forms of communication available to develop language competence at the earliest possible age. This implies introduction to a reliable receptive-expressive symbol system in the preschool years between the ages of one and five. Total communication includes the full spectrum of language modes: child devised gestures, formal sign language, speech, speechreading, fingerspelling, reading and writing (1971, p. 3).

Although it is not explicitly stated, total communication encourages the early use of gestures, speech, formal signs and any other technique to facilitate language acquisition. This is a marked departure from the simultaneous method which has traditionally been used with students after they have first received training through the oral method during the primary years.

One further distinction is important. "Combined methods" refers to any method of communication which employs any form of manual communication simultaneously with speech. "Combined systems" refers to educational systems where deaf children are instructed orally during the primary years and through simultaneous communication during intermediate and high school years.

Using these definitions as a frame of reference, more

parsimonious and explicit definitions have been formalized in quasi-mathematical form and presented in Table 1 to show the relationship between each of the methods of communication.

Table 1

Formal Definitions of Methods of Communication

Method	Modes of Communication					
	SS	FS	BL	S	(G)	EX_i
T.C. =	SS xx	FS x	BL x	S x	(G) x	EX_i
S.C. =	SS x	FS x	BL x	S x		EX_i
M.C. =	SS x	FS x	BL x		(G) x	EX_i
R.M. =		FS x	BL x	S x		EX_i
O.C. =			BL x	S x		EX_i

Where:

T.C. = Total communication
S.C. = Simultaneous communication
M.C. = Manual communication
R.M. = Rochester method
O.C. = Oral communication

and Where:

SS = Standardized signs
FS = Fingerspelling
BL = Body language
S = Speech (Including both audition and speech-reading)
(G) = The optional use of nonstandardized gestures
EX_i = The sum of all possible supportive and ancillary techniques and methods which can accompany any presentation of information.
x = interaction

Of those five methods of communication listed in Table 1, total communication, manual communication, and oral communication are being focused upon in this study.

Relevant Literature

Research dealing with methods of communication is useful only insofar as the outcomes provide educators of the deaf with additional information with which to make better decisions regarding methods to be employed in the educational setting. The outcomes of any research study must be examined against a backdrop of specific educational objectives.

It is generally accepted that the development of language and speech are crucial educational objectives in any educational system for deaf children. Inasmuch as academic achievement is so dependent upon the acquisition of language, most studies have focused upon general academic achievement. As a part of some studies researchers have in addition examined speech proficiency.

Although speech, as an educational objective, is subordinate to the acquisition of language, there is no question but that speech occupies a more important place in the minds of proponents of oral methods than in the minds of proponents of combined methods. It will be observed in the review which follows that the research suggests that only speech and articulation are better among subjects educated orally. The majority of the

research focuses upon academic achievement and supports philosophies which employ signs and/or fingerspelling.

At the end of this section a discussion is presented regarding the ability of hearing impaired children to assimilate information through two or more modes of input simultaneously. In addition, a brief discussion is presented giving reasons for including reading as a mode of communication.

Research Supporting Oral Communication

It has been suggested by some people that there is no evidence to support the oral method of communication. One of the major claims made by oral advocates is that by reducing the oralness of the environment, the probability of achieving intelligible speech is also reduced. Results from two studies and extrapolation from two others support this claim.

Quigley and Frisina (1961) conducted one of the first studies attempting to assess abilities of deaf children. Their primary objective was to assess the effects of instutionalization upon speech, speechreading, fingerspelling, and vocabulary. To do this they compared the performance of day and resident students at five residential schools. From 120 subjects, they conducted a secondary study--of prime interest in this review--by matching 16 students of deaf parents with 16 students of hearing parents; the implication being that deaf children

of deaf parents are exposed to more signs and fingerspelling and less speech than their peers who come from a hearing environment. The results indicated that the day-students had significantly better speech than the resident students. In addition, day-students of hearing parents had significantly better speech than day-students of deaf parents. From these two findings, the researchers concluded that the "oralness of the environment" significantly effects speech development.

As a result of the above findings the researchers hypothesized that there would also be a significant difference between the speech of deaf students in day schools and deaf students in residential schools.

Taking his lead from Quigley and Frisina, White (1969) compared the speech of day-students in a day program with a matched group of students from a residential school. Students were matched on age, sex, IQ, hearing loss and age of onset of deafness. In addition, both programs were under the same administration and teachers in both programs had the same general educational philosophy; in fact, several of the teachers had taught in both the residential and day program. White's findings supported Quigley and Frisina's hypothesis: deaf students in the day program made significantly fewer articulation errors than did the residential school students.

Other research conducted by Quigley (1967) and Stuckless and Birch (1966) comparing groups which varied

in the oralness of their environments showed that speech is slightly superior for the students from the more oral environment although differences were not statistically significant. Closer examination of Quigley's 1967 study, however, suggest that his conclusion of no statistical difference may be in error. First he matched subjects from three different schools using the Rochester method with subjects from three schools emphasizing oral methods. He next assessed the speech proficiency of both groups of subjects according to Hudgin's (1949) techniques and then analyzed the difference by a random samples "t" test; no significant difference was found in speech ability between subjects in the three pairs of schools. However, use of Winer's (1962; pp. 43-45) suggestion for combining "t's" leads to a reversal of that decision. Winer reports a "Z" statistic computed by summing across "t's" and dividing by the square root of the number of "t's". The statistic is normally distributed with a mean of zero and a variance of one. Using the information reported by Quigley (1967; p. 42; p. 60) a "Z" equal to approximately 2.25 was computed and under the null hypothesis that the mean value for the t-statistic in the population is zero, the null hypthesis can be rejected at the .01 level of significance. Interpreted, this means that if the students in four of the six schools studied by Quigley had equivalent speech,

there is less than one chance in a thousand that Quigley would have attained the "t" values he obtained. Thus, it appears that the results of Quigley's work did favor the oral students at a statistically significant level.

The purpose for presenting these studies by Quigley and Frisina (1961), White (1969) and the extrapolated interpretation from Quigley's (1967) later study was to make the reader aware that claims by proponents of manual methods that there is no evidence which supports the arguments of oral-only educators are not well founded. It appears that if gains in academic achievement are made possible through the use of combined methods, there is concomitantly a slight loss in speech intelligibility; possibly a result of a reduction in the oralness of the environment.

It must be remembered, however, that no causal relationship has been established between the use of signs and fingerspelling and poor speech intelligibility. The studies cited were ex post facto and thus the most that can be said is that there appears to be a slightly negative relationship between the use of manual skills and speech proficiency.

Research Supporting Combined Methods of Communication

Ex Post Facto Research. Ex post facto research is defined by Kerlinger as:

> "...that research in which the independent variable or variables have already occurred and in which the researcher starts with the observation of a dependent variable or variables." (1967; p. 360).

For example; deaf children of deaf parents and deaf children of hearing parents may be compared to show the effects of a manual versus an oral early environment on later communication skills. The independent variable which has already occurred, is the early environment. But to proceed on the assumption that the groups differ only on that single variable is dangerous. There is a high likelihood that there are other uncontrolled independent variables associated with the independent variable on the basis of which subjects were selected. In this case, for example, deaf parents may be more accepting, or the etiologies of the children of the deaf parents may differ systematically from those of hearing parents.

Thus, from ex post facto studies--as suggested above--one can only conclude that the independent variable is related to the dependent variable but one cannot assume that the relationship is causal. The crux of the matter is that control of extraneous independent variables cannot be assumed as is the case when subjects are assigned at random to treatments in an experimental design.

Six studies are presented in this section which have employed ex post facto designs. These studies are subject to criticism according to the deficiencies

just mentioned. Nevertheless, collectively they constitute a formidable argument in favor of combined methods of instruction.

In Quigley and Frisina's (1961) study described earlier, they found that students of deaf parents had significantly larger vocabularies than did their matched counterparts. In addition they found a +.87 correlation between vocabulary and academic achievement. This finding suggests that vocabulary and academic achievement have approximately 76 percent of their source of variability in common. More specifically, the correlation probably reflects greater language competence in the group with deaf parents, and it is possible and probable that language competence constitutes that factor which accounts for both greater vocabulary and academic achievement. It does not establish that signs and fingerspelling are the causal factors effecting language competence even though the researchers make this suggestion.

The wide circulation of the results of Quigley and Frisina's research undoubtedly provided impetus which sent other researchers in pursuit of causal factors to account for the differences in academic achievement among deaf children.

Shortly after Quigley and Frisina published their results, Stevenson (1964) utilized an ex post facto design and compared 134 deaf graduates of the California School

for the Deaf who had deaf parents with a matched group of students who had hearing parents. This group constituted all possible matched pairs of deaf graduates who had attended the school between 1914 and 1961. Only nine percent of the graduates who had hearing parents went to college whereas 38 percent of the deaf students of deaf parents received college training. In addition 90 percent of the graduates who had been exposed to early combined methods of communication through their home experiences reached a higher level of educational achievement. Stevenson's independent variable was early exposure to and use of signs and fingerspelling. Even though Stevenson's findings conclusively favor deaf graduates of deaf parents, several rival hypothesis exist in addition to his hypothesis that early exposure to signs and fingerspelling increases significantly academic achievement. Although not reported, probably a majority of the deaf parents were graduates of that or other residential schools themselves, and as a consequence were better able to counsel their children regarding the nature of the "educational system". The wide span of years from which subjects were drawn suggests that the etiological patterns of the children of hearing parents may have been much more heterogenous than those of deaf parents: Certainly the types and causes of deafness had changed between 1914 and 1961. Many children during the early

1900's were deafened through meningitis which also can effect brain tissue, but today this type of deafness is much less common. Stevenson's study lacked specificity in describing the exact nature of other differences between the children of deaf and hearing parents.

Meadows (1968), however, was much more specific. She matched 59 deaf children of deaf parents (the experimental group) with 59 deaf children of hearing parents (the control group), matching on age, sex, and IQ. She made the same tenuous assumption that the only systematic difference between groups was the extent of their exposure to combined methods of communication. The experimental group exhibited an average superiority of 1.25 years in arithmetic, 2.1 years in reading, and 1.28 years in over-all achievement. In addition, scores in over-all achievement indicated that the gap between the two groups increased with age, reaching 2.2 years in senior high school. Furthermore, teachers and counselors rated the experimental subjects as superior in written language, use of fingerspelling, use of signs, absence of communicative frustration and willingness to communicate with strangers. Meadows was bold in concluding that her results are a direct reflection of the cummulative effects of manual communication.

Stuckless and Birch (1966) also elected to focus upon the early effects of manual communication. They

identified 105 deaf children of deaf parents and matched them with 337 deaf children of hearing parents according to the following criteria: sex, school, hearing loss (70 db or greater in the better ear in the speech range, 500 to 2000 cps), and age of onset of deafness (before the age of two). Several deaf children of hearing parents were matched with each of the children of deaf parents because of the need for further refinement in the sample. In addition every single pair was matched for IQ using the same intelligence test as a basis for comparison. Finally, all parents filled out a questionaire on which they indicated whether or not manual communication had been used with their children. From the initial groupings 16 matched pairs were finally selected; deaf children of deaf parents who had used combined methods were designated as the experimental group, and deaf children of hearing parents who had used only the oral method were designated as the control group. The researchers found significant differences in favor of the experimental group on reading, lipreading, and written language; however, use of a series of t-tests inflates the possibility of making a Type I error. They also compared speech using a 2 x 2 Chi Square Table. They found no difference in speech although the results slightly favored the control group. As a result of these findings the researchers concluded that early manual communication: (1) appears

to have no influence on the intelligibility of speech; (2) facilitates the acquisition of speechreading skills; (3) facilitates the acquisition of language as mainifested through reading comprehension and written composition, and (4) has no negative influence on the psychological development of deaf children.

As cited earlier, the nature of the ex post facto design and matching techniques in no way assures the researchers that their assumption of equivalent, or random equivalence of groups was met; consequently, the conclusions of causality remain suspect.

Vernon and Koh (1971) also elected to employ the same basic design as Meadows and Stuckless and Birch in evaluating graduates of the John Tracy Clinic Program. They matched deaf children of deaf parents with the Tracy Graduates who attended the California School for the Deaf at Riverside. Comparing the two groups on speech, speechreading, academic achievement and reading yielded predictable results: significant differences were found in favor of the deaf children of deaf parents. Because deaf children of deaf parents have much greater exposure to signs and fingerspelling the researchers concluded that these factors caused the observed differences.

One of several confounding variables in the four studies reviewed employing ex post facto designs is that of etiology. Not infrequently it is suggested that deaf

children of hearing parents are more apt to have multiple problems resulting from the non-genetic factors which caused deafness. This being so, one might expect to find depressed academic performance in this population of non-genetic deaf children.

In an effort to dispose of this criticism Vernon and Koh (1970) conducted another study, this time matching children of hearing parents who were recessively deaf, as evidenced in their case histories, with deaf children of deaf parents. Matching resulted in 32 matched pairs.

These subjects were then compared on academic achievement, communication skills, and psychological adjustment. Once again the results indicated at a statistically significant level that children exposed to fingerspelling and signs were superior in academic achievement. Specifically, subjects who had used signs and fingerspelling were superior to their matched counterparts by 1.2 to 1.6 years. No differences were found between the groups on speech, speechreading, or psychological adjustment. As expected, the researchers concluded that obtained differences reflected the effect of using manual forms of communication.

In summary of these studies which have used ex post facto designs, two points should be made. First, within each study several rival hypotheses exist which could account for obtained differences. A few of the more

obvious ones are: (1) deaf parents may be more accepting of their children; (2) deaf parents usually send their children to residential schools whereas hearing parents most frequently send their children to day-school programs in their home community. It has been postulated that the deaf children of hearing parents in a residential school are less capable than deaf children of hearing parents in public school day programs; (3) despite Vernon and Koh's (1970) study, etiology may still be a partial cause for the consistent superiority of children of deaf parents. The interaction of these and other factors may well account for observed differences also.

The second point is that despite the arguments used against the studies individually, the combined effect upon the profession has been acceptance of the assertion that deaf children can learn more through use of finger-spelling and signs combined with speech--combined methods--than they can through oral communication alone. Considering the constraints under which research must be conducted--it is usually impossible to randomly assign children to treatment groups because of parental resistence, etc.--the evidence supporting combined methods is rather compelling.

Attempts at Experimental Research. The researchers who have carried out the aforementioned studies have

recognized, in part, the limitations of ex post facto designs. Three other studies have been identified which approximate experimental research; that is, where the researcher had some control over treatment conditions.

Johnson (1948) conducted a study wherein she attempted to assess the ability of deaf children at a residential school to assimilate 10 simple sentences presented under different modes of communication: (1) Manual (signs and fingerspelling); (2) Oral (speech only; no hearing aid used); (3) Accoustic (speech; hearing aids were used); (4) Speech-hearing (no speech-reading; audition only); and (5) Fingerspelling. Johnson did not indicate whether or not speech was used with the "manual" and "fingerspelling" modes.

With an N=253, it appears the entire population of the residential school was studied. However, the students at the school were segregated according to their ability to use their residual hearing and speech. Hard of hearing children were in the Acoustic Department. Deaf children unable to benefit from acoustic training were put in the Oral Department, and students who could not function in either the Oral or Acoustic Departments were put in the Manual Department. All Ss received all treatments.

Results indicated that all three groups of students understood approximately the same amount of information through fingerspelling, or fingerspelling combined with signs. Both the oral and manual groups understood significantly more through fingerspelling than any other mode of communication. The acoustic group understood more through acoustic communication (audition). The oral group did significantly better in the use of "speech-hearing", lipreading, and acoustic communication than the manual group. The acoustic group did significantly better than the oral group on the same three variables. In summary, Johnson drew three major conclusions: (1) using a hearing aid can significantly increase comprehension; (2) fingerspelling, and signs combined with fingerspelling are more effective than oral communication, and (3) fingerspelling alone was the most effective mode of communication for both oral and manual students.

Johnson exercised control in the study by designating the kinds of treatments which were administered to subjects and the conditions under which treatment was received. Basically, she assessed the ability of children to assimilate information under various modes of input; however, she failed to focus upon the contribution of speech in simultaneous communication.

Johnson's findings of the superiority of fingerspelling are interesting in light of later studies conducted

with the Rochester method by Quigley.

Quigley (1967) selected the Rochester method as the independent variable of interest in a longitudinal study carried out between 1963 and 1967. (This is the same study cited earlier (p.12) where "t" scores on speech were combined.) Three "experimental" schools were selected which used the Rochester method with all the children in the school. Each of these experimental schools was matched on the basis of relative geographical proximity, and similarity in the size and composition of student population with a control school which advocated a combined system of instruction. Subjects from the three experimental schools were then matched with subjects from the three control schools; matching was extensive. The mean age of students at the conclusion of the study was 13.18 years for the experimental and 13.25 years for the control group.

Student performance on the Stanford Achievement Test, written language, and speech were compared every year for five years. Initially no statistical difference existed between groups; however, at the conclusion of the study the experimental subjects scored significantly higher on all variables except speech. The researcher concluded that obtained differences reflect the superior influence of the Rochester method.

In the same official report Quigley explains that a second study, called an "experimental study" was begun near the completion of the larger study. The experimental study also focused on the influence of the Rochester method. Sixteen preschool deaf children in a residential school using the Rochester method were selected and matched with 16 preschool children at a comparable residential school which used only the oral method with preschool and elementary children. The researcher imposed control on the study by securing a commitment from the school administrations, dorm personnel, and parents that only the Rochester and oral methods would be used with each of the respective groups of children. For the oral group the children's dorms and classrooms were physically separated from the rest of the student population to reduce the possibility of contamination.

The results of the study revealed that the Rochester subjects were statistically superior in fingerspelling; on two measures of lipreading; on five of seven measures of reading ability, and on three of five measures of written language. The only difference in favor of the oral group was in "gramatical correctness", but this, the researcher concluded, reflected the fact that the oral subjects wrote shorter and less complex sentences. This study has been criticized on the grounds that the researcher failed to randomly select subjects and that

he matched subjects. Both procedures fail to provide unbiased estimates of the treatment effects. Further, experimenter bias may have had an effect upon critical personnel involved in operating both programs. Nevertheless, considering the practical constraints under which a researcher must labor, it seems that this later experimental study constitutes a respectable attempt to study the effects of the Rochester method and the oral method experimentally.

Sensory Overloading

In addition to studying the contribution of speech in total communication, and improving on the ex post facto design, the present study also attempts to provide additional information regarding the ability of segments of the hearing impaired population to decode information through various modes of input.

Close observation of total communication reveals that it is possible for a person to say one thing and sign or fingerspell another word with synonymous meaning. For example, a person may say; "I'm going home", but sign, "I am going home." Another example might be for a person to say; "I felt nauseated", but sign, "I felt sick". In the latter example the sign for sick and nauseated is the same. Even though there are now ways of putting the appropriate inflection and tense on words in sign language, it takes a great deal of concentration to do so. Very

seldom are all inflections and tense changes perfectly displayed through signs in total communication. The effect of such slight variations in the total communication process may very well be different for various segments of the hearing impaired population. Most adult deaf persons assert that they understand more through the combined use of speech, fingerspelling and signs than they do through just manual communication alone. However, for some deaf people, particularly those who are less verbally competent, the variations between the manual component and the verbal component may slightly inhibit assimilation of what is being said. Such a hypothesis seems even more plausible when one considers the work of Gaeth.

Gaeth (1966) studied several aspects of verbal and nonverbal learning in normal children and hearing impaired children. He found that when word lists were presented to subjects their recall was significantly greater when the words were presented either visually or auditorily than when the words were presented through visual and auditory modes simultaneously. He also found that his normal and profoundly deaf subjects quickly adapted to the mode which was most meaningful to them; the normals listened, and the deaf watched. Interestingly enough he found the hard of hearing trying to shift back and fourth between listening and watching; this strategy resulted in depressed scores.

It maybe that this same phenomenon exists with regard to total communication. Will attempts at shifting from one mode of communication (manual) to another (speech) result in depressed scores on assimilation of factual material? Respecting the assertions of many adult deaf people who say that they receive more through total communication than they do through manual communication, it is hypothesized that average and bright deaf students are sufficiently adroit in shifting attention from the hands to the lips so that under total communication more information will be assimilated; however, it is further hypothesized that lower functioning deaf children will not be able to process the slight variations between the manual component and speech component as effectively and in fact their attempts to do so will result in depressed scores on the dependent variable of assimilation of factual material.

Reading as a Method of Communication.

Even though all educators of the deaf use reading a great deal in their efforts to communicate with the deaf, the literature reveals no attempt to compare the ability of deaf students to assimilate information through reading and through oral, or total communication.

It is generally accepted that when syntactic patterns are not unduly complex and when the vocabulary is not

beyond the ability of the student more information can be assimilated through reading than through oral communication. Many people would say this assertion holds true for combined methods as well, although some educators feel that more information is transferred through total communication than through reading.

Inasmuch as no empirical evidence exists to support these assertions, reading was included as a means of communication and was compared to the oral, total, and manual methods of communication.

Hypotheses

It is hypothesized that hearing impaired children will assimilate more factual information when it is presented to them through total communication and manual communication than they will through oral communication.

It is hypothesized that average or higher functioning hearing impaired children will assimilate more factual information when it is presented to them through total communication than they will through manual communication.

It is hypothesized that lower functioning hearing impaired children will assimilate more factual information when it is presented to them through manual communication than they will through total communication.

It is hypothesized that hearing impaired children will assimilate more factual information when it is

presented through reading than they will through oral, total, or manual communication.

CHAPTER II

DESIGN OF THE STUDY

Method of communication of factual material, or mode of input, was the independent variable of primary interest in this study. Four methods of communication were used: (1) oral communication, (2) total communication, (3) manual communication, and (4) reading. Factual material was presented to a stratified random sample of students from a residential school for the deaf under each of these four levels on the fixed independent variable. Two other fixed independent variables, age and IQ with three levels on each were incorporated in the design to gain greater precision and to investigate the effects of these variables on the dependent variable which was assimilation of factual information.

To control for bias in treatment groups, subjects were exposed to repeated treatments: each treatment was one method of communication. Thus subjects were compared to themselves and not to a random or matched group. It was reasoned that by controlling as many extraneous variables as possible and by allowing the method of communication to be the only systematic difference between groups, test differences observed on the dependent variable should reflect how much information was transferred from the presenter-of-the-material to subjects, or stated

differently; how much information was assimilated under the various methods of communication.

Generalizations made from this study should be restricted to populations which reflect the composition of the random sample and the residential school from which they were drawn.

A description of the sample, scheduling of subjects for testing, selection of test material, and a description of the experimental design are presented in this chapter.

Sample

A stratified random sample of 45 hearing impaired children was drawn from the Maryland School for the Deaf in Frederick, Maryland. The school has a student population of 330; 185 male and 145 female. Students range in age from four to 19. All but seven students attend as resident-students. Approximately 195 students are eleven years of age or older.

The random sample was obtained by first assigning all students in the school between the ages of 11.0 and 18.7 years to the age and IQ groups shown in Table 2. Of this population, those with a mean hearing loss in the speech range (500,1000,2000 Hz) less than 65 db were eliminated from the study. Students whose IQ was below 60 on the performance scale of the Wechsler Intelligence Scale for Children were also eliminated

Table 2

Stratification of the Population of Hearing Impaired Children

Age	Intelligence Quotient		
	60-89 IQ (L)	90-110 IQ (M)	111-Above (H)
(L) 11.0-13.5 years	Group-1	Group-2	Group-3
(M) 13.6-16.1 years	Group-4	Group-5	Group-6
(H) 16.2-18.7 years	Group-7	Group-8	Group-9

L=Low; M=Middle; H=High

from the sampling population. IQ scores were taken from school records.

From the remaining population of 145, five subjects (Ss) were randomly selected from each of the nine groups in Table 2 using a table of random numbers; hence, N=45.

The mean age, IQ, hearing loss, and reading level for each of these nine groups are presented in Table 3.

The means and standard deviations for each of the three levels of age and IQ are presented in Table 4.

The grand mean and standard deviations for the entire sample on hearing loss, reading, and IQ are presented in Table 5.

Table 3

Means for Age, IQ, Hearing Loss and Reading Level for the Stratified Sample

Age-IQ Groups	Age in Years	IQ	Hearing Loss(db)	Reading Level *
Group-1	12.50	79.60	90.60	2.36
Group-2	12.50	103.80	93.40	2.58
Group-3	12.10	122.20	96.60	3.26
Group-4	15.30	78.20	82.60	2.12
Group-5	14.90	98.60	81.60	4.08
Group-6	14.50	120.40	90.60	4.08
Group-7	17.40	74.80	85.00	3.10
Group-8	17.50	102.60	81.80	3.68
Group-9	17.50	123.00	92.00	4.30

* Sub-test on Stanford Achievement Test

Table 4

Means and Standard Deviations for Each Level of Age and IQ

	Age			IQ		
	A-L	A-M	A-H	IQ-L	IQ-M	IQ-H
Means	12.42 yr.	14.92 yr.	17.49 yr.	77.33	101.66	121.87
S.D.	14.78 mo.	9.41 mo.	6.15 mo.	8.08	6.73	6.96

Table 5

Means and Standard Deviations for the Entire Sample on Hearing Loss, IQ, and Reading Level

	Hearing Loss	IQ	Reading Level
Means	88.24 db	100.29	3.28
S.D.	11.40 db	20.00	1.13

In an effort to determine if hearing loss was confounded with age or IQ, a 3 x 3 fixed effects model analysis of variance was carried out with the two fixed factors being age and IQ. The results of the analysis in Table 6 indicate that hearing loss was not significantly related to age or IQ.

Table 6

Analysis of Variance Table on Hearing Loss for the Factors of Age and IQ

Sources of Variation	df	SS	MS	F	P*
Age	2	642.72	321.36	2.58	NS
IQ	2	524.85	262.42	2.11	NS
Age x IQ	4	80.75	20.13	.17	NS
Subjects: Age x IQ	36	4,474.00	124.27		

* alpha = .05; NS=Not Significant

History of Sample and School

All the Ss in the sample were born deaf except for three, and those three were deafened before the age of three years. Of the 42 Ss born deaf, 21 are congenitally deaf and 21 are deaf as a result of unknown causes.

Of the entire sample all but three were at the Maryland School for more than three years. Two of the 45 Ss were residents of two years and only one was a resident student for one year.

Historically the Maryland School has employed a combined system of education; however, three years prior to the study the school embraced total communication and since that time has used total communication at all age levels. From observation it appeared that the entire staff enthusiastically practices total communication at the school.

Design and Experimental Methods

A 3 x 3 x 4 factorial repeated measures design, fixed effects model was used. The first factor, method of communication, consisted of four levels: (1) oral communication, (2) total communication, (3) manual communication, and (4) reading.

The second factor was age. It was primarily included as a blocking variable. Three levels were specified on this factor: (1) 11.0 to 13.5 years of age (Age-Low);

(2) 13.6 to 16.1 years (Age-Middle); and (3) 16.2 to 18.7 years (Age-High).

The third factor, IQ, was also used as a blocking variable; however, more interest was invested in it. Particular interest in this variable existed because of the hypothesized interaction between method and IQ. Three levels were specified on this factor as well: (1) 60 to 89 IQ (IQ-Low); (2) 90 to 110 IQ (IQ-Middle); and (3) 111 IQ and above (IQ-High).

A data matrix is presented in Figure 1.

Definition of Methods

Four methods of communication were presented to all Ss in the study. The four levels on the first factor constituted treatment. All material under each of the methods was administered to Ss by the same person who was a certified interpreter for the deaf; the interpreter was not a member of the school staff.

Age	IQ	Ss	Method-1	Method-2	Method-3	Method-4
Age - L	IQ - L	S-1 S-2 S-3 S-4 S-5				
	IQ - M	S-6 . . . S-10				
	IQ - H	11 . . . 15				
Age - M	IQ - L	16 . . . 20				
	IQ - M	21 . . . 25				
	IQ - H	26 . . . 30				
Age - H	IQ - L	31 . . . 35				
	IQ - M	36 . . . 40				
	IQ - H	41 . . . 45				

Figure 1

Data Matrix of the 3 x 3 x 4 Repeated Measures Design

Method-1. Under method-1 Ss were presented factual information orally. The oral method was defined in Chapter 1 as:

$$O.C. = BL \times S \times EX_i$$

By definition speech (S) is only one part of the oral method; however, it is the most important part of the method and thus the component of prime interest. Material was presented to the Ss through speech by the interpreter who was encouraged to use all natural body language (BL). The students were encouraged to wear their hearing aids.

Proponents of oral methods have always argued that "talking" alone does not constitute the oral method; a host of other techniques are drawn upon. However, the techniques and inputs (EX_i) are common to all methods of communication; therefore, it was decided not to deal with this component in any form in the various methods of communication. In short, no visual aids or other communicative levers were used in any of the methods of communication. The primary component within the various methods was focused upon.

The measured rate at which the material was presented is provided in Table 7.

Table 7

Mean Length of Time in Which Material was Presented*

	Oral-1	T.C-2	Manual-3
Means	3.43 min.	3.62 min.	3.59 min.
S.D.	30.75 sec.	42.23 sec.	55.47 sec.

* Mean and S.D. for reading was not computed because of variability between students in reading time.

Method-2. Under method-2 Ss were presented passages of factual information by the interpreter using total communication. The interpreter presented the material in signed English using Gallaudet endings, such as;--ion, ---ment,--ing, etc. The interpreter was encouraged to use all the components of communication specified in the formal definition:

$$T.C. = SS \times FS \times BL \times S \times (G) \times EX_i$$

Inasmuch as the vocabulary in the passages of factual material was not difficult there was little need for contrived gestures; thus non-standardized gestures (G) were deleted along with (EX_i). It will be observed that with (G) deleted, total communication and simultaneous communication are equivalent.

The words which were signed and fingerspelled in the passages used under total communication are presented in Appendix A. It will be noted that some words

were both signed and fingerspelled.

The rate of presentation of material under total communication is also presented in Table 7.

Method-3. Under method-3 Ss were presented the material by manual communication. Manual communication was defined as:

$$M.C. = SS \times FS \times BL \times (G) \times EX_i$$

For the same reasons cited for method-1 and method-2, (G) and EX_i were deleted from manual communication during testing. With these components deleted, the only difference between manual communication and total communication was speech (S); thus a statistical difference observed between total and manual communication will be attributed to the effect of speech:

$$M.C. = SS \times FS \times BL$$

$$T.C. = SS \times FS \times BL \times S$$

The words which were signed and fingerspelled are presented in Appendix B and the rate of presentation is presented in Table 7.

Method-4. Under method-4 the Ss were handed a dittoed copy of the factual information and given a specified time in which to read it. For passages B, three minutes were allowed, and for passages D, four minutes were allowed. It should be noted that there appeared to be rather broad variability in time taken by the students in reading.

Besides setting a maximum time limit which approximated the mean length of time it took to present the other methods no control over reading time was imposed.

Scheduling of Ss for Testing

Once the 45 Ss were selected, each of the five Ss within the nine age-IQ groups specified in Table 2 was given a numerical code, so that Ss in group-1 were coded 1,2,3,4, and 5; Ss in group-2 were coded 6,7,8,9, and 10 and so forth, up to group-9 which was coded 41,42,43,44, and 45. Once coded, the Ss from the nine groups were then systematically assigned to testing groups. A testing group was defined as a group of seven or eight Ss who were tested together. Ss were assigned to testing groups as presented in Table 8.

Table 8

Composition of Testing Groups

Testing Groups	Age-IQ Groups								
	G-1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9
TG-1	S_1	S_7	S_{13}	S_{19}	S_{25}		S_{31}	S_{37}	S_{44}*
TG-2	S_2	S_8	S_{14}	S_{20}		S_{26}	S_{32}	S_{38}	
TG-3	S_3	S_9	S_{15}		S_{21}	S_{27}	S_{33}	S_{39}	S_{45}*
TG-4	S_4	S_{10}		S_{16}	S_{22}	S_{28}	S_{34}	S_{40}	S_{43}*
TG-5	S_5		S_{11}	S_{17}	S_{23}	S_{29}	S_{35}	S_{41}	
TG-6		S_6	S_{12}	S_{18}	S_{24}	S_{30}		S_{36}	S_{42}

S_{14}=Subject coded 14 from age-IQ group 3; assigned to testing group 2

*Ss were randomly assigned to testing groups.

To eliminate "time of day", "day", and "order of presentation" of method as confounding variables testing groups were systematically assigned to receive testing according to the schedules in Tables 9 and 10.

Table 9

Schedule of the "Day" and Order of Method of Presentation*

Testing Groups	Day of Testing		
	Day-1	Day-2	Day-3
TG-1	Oral	T.C.	Manual
TG-2	Oral	Manual	T.C.
TG-3	T.C.	Oral	Manual
TG-4	T.C.	Manual	Oral
TG-5	Manual	T.C.	Oral
TG-6	Manual	Oral	T.C.

* Reading was nested within each of the three days. See Table 11.

Table 10

Schedule Indicating "Day", "Time of Day", Testing Groups Were Tested and the Method Received

Time of Day	Day of Testing		
	Day-1	Day-2	Day-3
Period-1	TG-1,2* Oral	TG-1,5 T.C.	TG-1,3 Manual
Period-2	TG-3,4 T.C.	TG-2,4 Manual	TG-4,5 Oral
Period-3	TG-5,6 Manual	TG-3,6 Oral	TG-2,6 T.C.

* This entry should be read, "Testing groups 1 and 2 received the oral method at period-1, on day-1.

Materials Used

As mentioned, the dependent variable was "assimilation of factual information". To assess this variable 16 factual passages were taken from Getting the Facts: Specific Skill Series, Book B and Book D (Barnell Loft, Ltd 1966). According to the publisher the eight passages from Book B were at the second grade level and the eight passages from Book D were at the fourth grade level.

Each of the eight passages from the set of passages taken from Book B was randomly assigned for use with a single method of communication. Each of the eight passages from set D was also assigned randomly for use with one of the four methods of communication. When this procedure was completed each method of communication had four passages randomly assigned to it; two from Book B and two from Book D.

Each passage from Book B also had a standard set of eight questions associated with it. Each passage from Book D had ten questions associated with it. These questions were used to assess how much information had been assimilated under each method of communication. Each question was a three-foil multiple choice question. The total number of questions presented to S under each method was 36; two sets of questions from Book B (8 + 8 = 16 questions) and two sets of questions from Book D (10 + 10 = 20 questions).

Under each method of communication the interpreter presented a passage of factual information to two testing

groups. Immediately following the presentation, the questions associated with the passage which was given were distributed to the Ss. The Ss were required to read the questions and circle the right answer, On day-1 and day-3 five passages and their respective questions were administered to the Ss. On day-2 six passages and their respective questions were presented. The variation in the number of passages presented per day existed because only one reading passage was given on day-1 and day-3; however, on day-2 two reading passages were presented (See Table 11).

A schedule indicating which passages were presented under each method of communication is presented in Table 11. Table 11 also illustrates how the reading passages were inserted into the alloted three day testing period.

Table 11

Schedule Indicating the Insertion of Reading Treatment Over the Three Day Testing Period and the Passages Presented Under Each Method of Communication

Time of Day	Day of Testing		
	Day-1	Day-2	Day-3
Period 1	Oral Passage-19-B* Passage 21-B Passage 22-B Passage 19-D Passage 24-D	T.C. Passage 20-B Passage 24-B Passage 25-B* Passage 18-D* Passage 21-D Passage 22-D	Manual Passage 18-B Passage 23-B Passage 23-D Passage 25-D Passage 20-D*
Period 2	T.C. Passage 19-B* Passage 20-B Passage 24-B Passage 21-D Passage 22-D	Manual Passage 18-B Passage 23-B Passage 25-B* Passage 18-D* Passage 23-D Passage 25-D	Oral Passage 21-B Passage 22-B Passage 19-D Passage 24-D Passage 20-D*
Period 3	Manual Passage 19-B* Passage 18-B Passage 23-B Passage 23-D Passage 25-D	Oral Passage 21-B Passage 22-B Passage 25-B* Passage 18-D* Passage 19-D Passage 24-D	T.C. Passage 20-B Passage 24-B Passage 21-D Passage 22-D Passage 20-D*

* These passages were presented through reading

The material used in the study was reviewed by the researcher, two teachers working with the Ss, the school principal, and an outside consultant; this team agreed that the material appeared to be suitable for the purposes of the

study. Several factors were considered in selecting the material: (1) the age range of the sample, (2) the reading ability of the Ss (Examination of school records revealed a mean grade level of reading achievement of 3.28); and (4) the degree to which the material focused upon teaching facts which the Ss were most likely unfamiliar with.

Procedures for Testing

Room. All testing was conducted in a single room made available by the school administration. The room was large enough to accommodate comfortably two testing groups. Two groups were tested together in order to reduce the number of presentations made by the interpreter and the number of times teachers' classes were interupted. Care was taken to ensure a dark background so that the interpreter could be easily seen. Lighting in the room was adequate for speechreading.

Instructions. On day-1, before any passages were presented the interpreter, using total communication, gave the following instructions.

> We (speaking of herself and the researcher) are trying to understand better how deaf students learn. We want you to read this story and when you are finished answer some questions about it. Read the story carefully. Don't raise your hand if you don't understand. We can't answer any questions. You have three (four) minutes. We will pass out the papers face down. When we blink the lights turn the paper over and begin reading. When you finish we will pass out some questions for you to answer.

The following instructions were also given through total communication on day-1.

> Oral. Now I'm going to read you a story. I'm not going to use my hands to sign or fingerspell. You will have to lipread what I say. Don't raise your hand if you don't understand; I can't stop to answer questions. Watch carefully and try to understand what I say. When I finish I will pass out some questions for you to answer.
>
> Total Communication. Now I'm going to read you a story using total communication. Don't raise your hands if you don't understand; I can't stop to answer questions. Watch carefully and try to understand what I say. When I finish I will pass out some questions for you to answer.
>
> Manual Communication. Now I'm going to read you a story using just signs and fingerspelling. I'm not going to speak so you will have to watch my hands. Don't raise your hand if you don't understand; I can't stop to answer questions. Watch carefully and try to understand what I say. When I finish I will pass out some questions for you to answer.

While the interpreter presented the passages the researcher sat at the rear of the room and timed the rate of presentation for each passage; this information is presented in Table 7 (p. 40).

The variable of "rate of presentation" was analyzed using method and day of presentation as fixed independent variables, by means of analysis of variance. The implied null hypothesis of no significant difference between time 1,2, and 3 across methods, on the dependent variable of rate of presentation, was not rejected. The results of the analysis are presented in Table 12.

Table 12

Analysis of Variance Table for Rate of Presentation of Factual Information

Source of Variation	df	SS	MS	F	P*
Time	2	109	54.5	.02	NS
Method	2	53	26.5	.01	NS
Time x Method	4	918	229.5	.67	NS
Rate: Time x Method	12	40,848	3,404.0		

* Alpha set at .05

Reading was not included in this analysis because the time alloted for reading was not controlled; each S read the passages at his own rate of speed. As mentioned above, the maximum time given to Ss to answer the questions on B passages and D passages was three minutes and four minutes respectively. Observation of Ss under reading indicated clearly that only a very few Ss ever took the alloted time; hence, if anything, Ss took less time to assimilate information under reading, as compared with the other methods of communication.

CHAPTER III

RESULTS OF THE ANALYSIS

It was hypothesized that: (1) hearing impaired children will assimilate more factual information when it is presented to them through total and manual communication than they will through exclusively oral communication; (2) average and higher functioning hearing impaired children will assimilate more factual information when it is presented to them through total communication than they will through manual communication; (3) lower functioning hearing impaired children will assimilate more factual information when it is presented to them through manual communication than they will through total communication, and (4) hearing impaired children will assimilate more factual information when it is presented through reading than they will through oral, total or manual communication.

In addition to a description of ancillary findings, a decision of acceptance or rejection was made regarding each of the hypotheses following analysis and these results are presented in this chapter.

Prior to the main analysis of the data, consideration was given to the assumptions underlying the use of analysis of variance in a repeated measures design. Four such assumptions are essential: (1) normality of the population from which the sample was taken; (2) equality of variance across treatment conditions; (3) independence between

subjects, and (4) equal correlation between all possible combinations of treatment conditions. Where sample size is equal across treatment groups (methods of instruction) violation of the first two assumptions is of little consequence. In order to insure non-violation of the third assumption, subjects were closely observed while they answered the questions to assure that they worked independently. The fourth assumption, an assumption specific to a repeated measures design, was more difficult to accept. Inasmuch as it is crucial to meet this assumption before proceeding, correlations were computed to determine the appropriateness of making this assumption in the subsequent analysis.

The Ss' scores across the nine levels of age and IQ were first correlated across methods of communication. This resulted in 54 correlation coefficients (nine levels, and six possible method combinations at each level). Each of the 54 correlation coefficients were transformed using an "r" to "z" transformation. The mean of the z scores was computed for each of the treatment combinations and that mean was then transformed back to a correlation coefficient. These adjusted correlations were computed because they are slightly more accurate than a simple correlation computed across all Ss independent of levels. Adjusted correlation coefficients are reported in Table 13.

Table 13

Matrix of Correlation Coefficients Between Methods of Communication

	Oral	T.C.	Manual	Reading
Oral Communication	-	.49	.41	.32
Total Communication		-	.80	.64
Manual Communication			-	.80
Reading				-

Inasmuch as the range in correlation coefficients (.32 to .80) was large, which renders the assumption of equality of correlations across treatments suspect, the Geisser and Greenhouse Conservative F-test (Kirk, 1968; pp. 142-143) was used throughout the analyses, both in the over-all F-test and in generating specific contrasts between means using the Tukey method.

The mean number of correct responses and the standard deviations under each method of communication are presented in Table 14. Table 15 presents the grand means for the factors of age and IQ across all levels of communication. It can be observed that the mean number of correct responses under oral communication is conspicuously lower than the other three methods of communication. Likewise, the means for the younger group (A-L) and lower IQ group (IQ-L) stand apart from the other two levels on this combined measure of communication skill.

Table 14

Mean Number of Correct Responses and Standard Deviations for Methods of Communication

	Oral	T.C.	Manual	Reading
Means	15.67	23.73	25.51	27.36
S.D.	4.82	6.08	5.31	6.21

Table 15

Grand Mean Number of Correct Responses for Levels of Age and IQ

	Age			IQ		
Levels	A-L	A-M	A-H	IQ-L	IQ-M	IQ-H
Means	20.85	23.97	24.38	20.13	24.48	24.58

L=Low; M=Middle; H=High

Main Analysis

In order to test for the statistical significance of the differences between means and possible interaction effects the data were subjected to an analysis of variance. Table 16 presents the sources of variation, the degrees of freedom, the adjusted degrees of freedom used in looking-up critical values, the sum of squares, the mean squares and the F-values.

Table 16

Summary Table for 3 x 3 x 4 Analysis of Variance

Sources of Variation	df	SS	df**	MS	F
Method (M)	3	3,580.40	1	1,193.62	94.32*
IQ (I)	2	774.70	2	387.35	6,67*
Age (A)	2	447.43	2	223.72	4.02*
A x I	4	423.47	4	105.87	1.82
A x M	6	152.92	2	25.49	2.01
I x M	6	255.79	2	42.63	3.37*
M x A x I	12	73.22	4	6.10	.48
Ss: A x I	36	2,092.20	36	58.11	
M x Ss: A x I	108	1,366.70	36	12.65	

* Significant at the .05 level of significance
**Adjusted degrees of freedom

As indicated in Table 16 there was a significant effect due to method of communication, age, intelligence, and a method by intelligence interaction.

The interaction effect was plotted to see if the interaction was ordinal or disordinal before post hoc procedures were carried out. As indicated in Figure 1, interaction was ordinal and thus generalizations across levels on the factor of IQ for methods of communication were possible. That is, mean scores on the four methods of communication have the same rank order at each IQ level. The same holds true for age levels.

Observation of Figure 2 reveals that low, middle and high IQ groups do not differ significantly under oral communication, whereas they do differ under the other three modes of communication.

Having determined that differences existed between methods of communication, age and IQ it was necessary to construct contrasts on the means in order to locate specific differences. Constructing contrasts implies a null hypothesis of no difference between two or more means; that is, the difference between two or more means is zero. If the difference between two means, plus or minus a stretching factor, spans zero, then the null hypothesis of no difference should not be rejected; if the interval generated does not span zero then the null should be rejected and a significant difference is indicated between populations from which the sample means were drawn.

Confidence intervals, of the kind specified above, were constructed and are presented in Table 17 for the main factor of method of communication. Alpha was set at the .05 level for all contrasts.

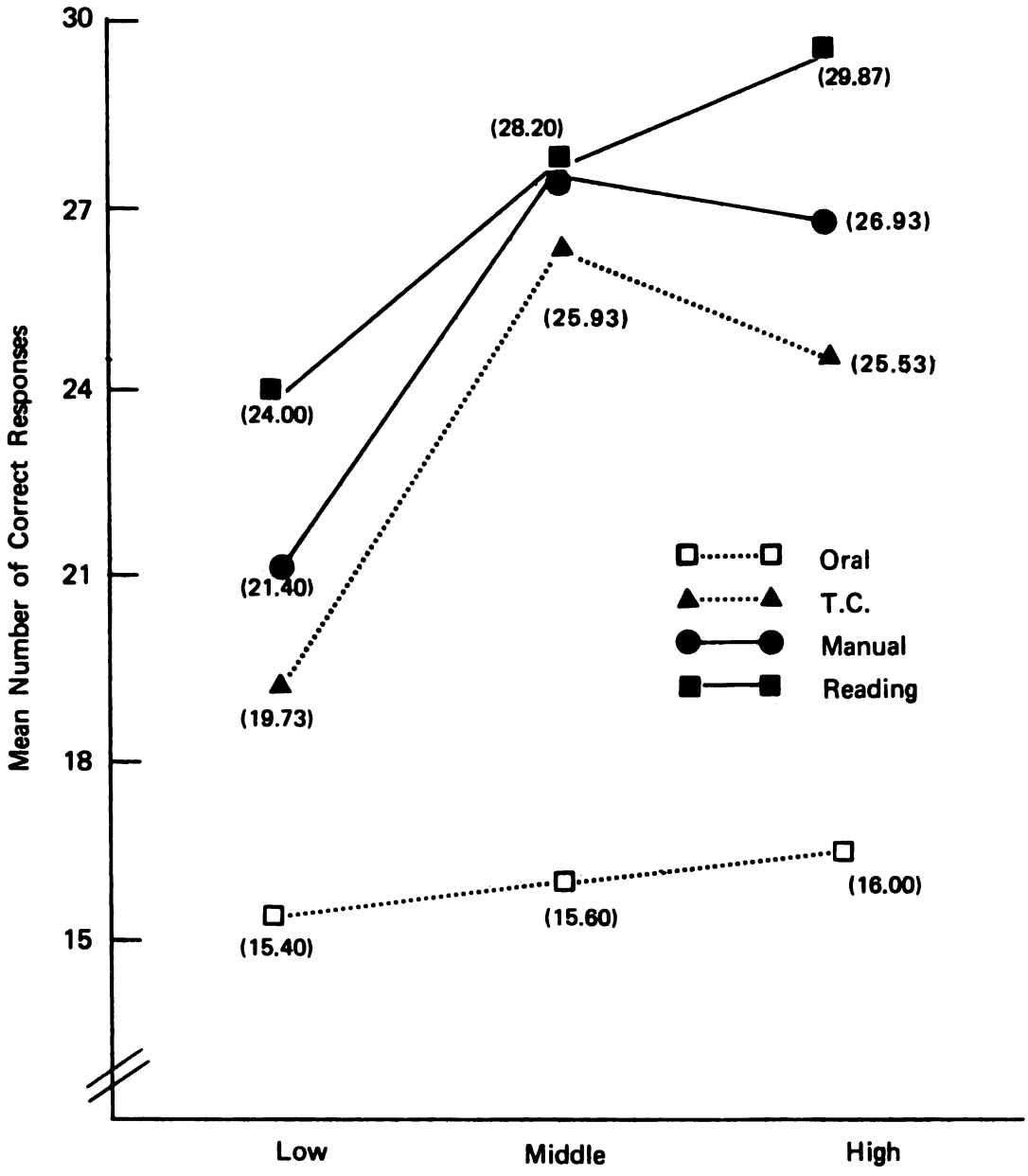

Figure 2

Mean Number of Correct Responses for Low, Middle and High IQ Groups in the Maryland Study

Cont

$\bar{X}_{T.C}$

$\bar{X}_M$

$\bar{X}_R$

$\bar{X}_M$

$\bar{X}_R$

$\bar{X}_R$

O=C

Exa

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Table 17

Contrasts on the Main Factor of Methods of Communication

Contrast	Difference between Means	Confidence Interval	Decision
$\bar{X}_{T.C.}-\bar{X}_{O}$	23.73-15.67=8.06	6.02 to 10.10	Sig.Difference
$\bar{X}_{M}-\bar{X}_{O}$	25.51-15.67=9.84	7.80 to 11.88	Sig.Difference
$\bar{X}_{R}-\bar{X}_{O}$	27.36-15.67=11.69	9.63 to 13.71	Sig.Difference
$\bar{X}_{M}-\bar{X}_{T.C.}$	25.51-23.73=1.78	-.26 to 3.82	No Difference
$\bar{X}_{R}-\bar{X}_{T.C.}$	27.36-23.73=3.62	1.58 to 5.66	Sig.Difference
$\bar{X}_{R}-\bar{X}_{M}$	27.36-25.51=1.85	-.19 to 3.89	No Difference

O=Oral; T.C.=Total Communication; M=Manual; R=Reading

Exact Hypotheses

It was hypothesized that hearing impaired children would assimilate more factual information through total and manual communication than they would through exclusively oral communication. As indicated in Table 17 this hypothesis was supported by the results of the analysis. Inasmuch as the mean amount of information under oral communication was significantly lower than the mean for total or manual communication it was concluded for this population of hearing impaired children that they do indeed assimilate more information when it is presented using total or manual communication.

It was hypothesized that average and higher functioning hearing impaired children would assimilate more factual

information when it was presented through total communication than they would through manual communication. This hypothesis was clearly not supported by the research findings. This fact can be observed in Figure 2, and Table 18. The means for both the middle and higher IQ groups under total communication were lower than they were under manual communication. Since these results are opposite to what was predicted no test of significance was necessary.

It was hypothesized that lower functioning hearing impaired children would assimilate more factual information through manual communication than they would through total communication. As indicated in Table 18, the lower functioning children did assimilate more through manual communication. In order to determine if that difference was significant, a confidence interval was constructed around the difference between the means of the lower IQ group under total and manual communication; this information is presented in Table 19.

Table 18

Mean Scores Across Low, Middle and High IQ Levels for Methods of Communication

	Oral	T.C.	Manual	Reading
IQ-L	15.40	19.73	21.40	24.00
IQ-M	15.60	25.93	28.20	28.20
IQ-H	16.00	25.53	26.93	29.87

Table 19

Contrast Comparing Means of Low IQ Ss on Total and Manual Communication

Contrast	Difference Between Means	Confidence Interval	Decision
$\bar{X}_M - \bar{X}_{T.C.}$	21.40-19.73=1.67	-2.54 to 4.88	No Difference

As indicated in Table 19 the low IQ Ss did not do significantly better under manual communication than they did under total communication. It was generally concluded, therefore, that manual and total communication were not significantly different for lower, average, or higher functioning hearing impaired children.

It was also hypothesized that hearing impaired children would assimilate more factual information when it was presented through reading then they would through oral, total, or manual communication. This hypothesis was partially supported. As indicated in Table 17 performance on reading did not differ significantly from performance under manual communication; however, it did differ significantly from both oral and total communication. It was thus concluded that reading was significantly superior to oral and total communication as a method of presenting factual information to hearing impaired children.

Ancillary Findings

Contrasts were also constructed using the means for the three levels of age and IQ. The results are presented

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in Tables 20 and 21. These results indicated that; (1) lower functioning hearing impaired children differ significantly in performance from the higher functioning children, and the middle functioning children. The middle and high IQ groups did not differ significantly from each other; (2) younger age Ss did not differ significantly from the middle age Ss, but the younger Ss did differ significantly from the older age Ss. The middle and older age Ss did not differ significantly in their ability to assimilate factual information.

Table 20

Contrasts on the Factor of Age

Contrast	Difference Between Means	Confidence Interval	Decision
$\bar{X}_M - \bar{X}_L$	23.97-20.85=3.12	-.31 to 6.57	No Difference
$\bar{X}_H - \bar{X}_M$	24.38-23.98= .40	-3.03 to 3.83	No Difference
$\bar{X}_H - \bar{X}_L$	24.38-20.85=3.53	.10 to 6.96	Sig.Difference

Table 21

Contrasts on the Factor of IQ

Contrast	Difference Between Means	Confidence Interval	Decision
$\bar{X}_M - \bar{X}_L$	24.48-20.13=4.35	.92 to 7.78	Sig.Difference
$\bar{X}_H - \bar{X}_M$	24.58-24.48= .10	-3.33 to 3.53	No Difference
$\bar{X}_H - \bar{X}_L$	24.58-20.13=4.45	1.02 to 7.88	Sig.Difference

Summary

Based upon the results of the analysis and restricted to the population from which the sample was drawn, certain generalizations are possible:

1. Hearing impaired children assimilate more factual information through reading than they do through oral or total communication.

2. All categorical sub-groups of hearing impaired children assimilate more factual information through total communication, and manual communication than they do through oral communication.

3. High, middle and low IQ groups assimilate approximately the same amount of factual information through oral communication.

4. Bright (IQ-High) and average (IQ-Middle) hearing impaired children assimilate more factual information than lower functioning children (IQ-Low) when that information is

presented through total communication, manual communication and reading.

5. Older (Age-High) hearing impaired children assimilate more factual information than younger children (Age-Low), but not significantly more than children in the middle group.

6. The speech component in total communication does not significantly increase the amount of factual information assimilated beyond that assimilated through manual communication.

CHAPTER IV

REPLICATION OF THE MARYLAND STUDY

A replication of the Maryland study was conducted in order to determine the degree to which the findings of that study can be generalized to populations of hearing impaired children who have not been exposed to the systematic practice and philosophy of total communication.

There are likely to be some differences between populations of children educated in different parts of the country, under different personnel with different educational philosophies. Recognizing the potential for differences in learning styles between the students at various residentials schools, it is difficult to make sweeping generalizations based upon the results of the Maryland study without further examination of other residential populations. The desire to more broadly generalize from the previous study and at the same time further verify the findings of that study constituted the primary purpose for conducting this replication.

The population of the Michigan School for the Deaf was identified as a population which was sufficiently different from the Maryland population to make the replication worthwhile. In contrast to the Maryland administration, the Michigan administration has professed a much greater affinity for the oral method of instruction.

The primary department is maintained as a purely oral educational system. As part of the school curriculum, both upper and lower grades take a speech class, and considerable emphasis is placed upon the development of speech and speechreading skills. In the upper grades the Michigan School is much like many other residential schools throughout the country in that the administration makes a strong effort to develop functional speech, but has not forbidden the use of signs and fingerspelling among staff and students. The superintendent stated, in private conversation, that as a school they adhere primarily to the oral philosophy of education.

Consistent with their emphasis upon oral education, 106 of the 348 student population are listed as day students (American Annals of the Deaf, 116, 1971, p. 173). The fact that such a large proportion of the population do attend the school as day students suggests that they have more exposure to the hearing society than students in the Maryland school.

If the claims of oral proponents are correct, this exposure should increase the speech and speechreading capabilities of the students.

Procedures

In conducting the replication, the same procedures were followed as outlined in Chapter 2 with the Maryland

study except for the following changes: (1) a different interpreter was used; (2) the Ss in each of the nine age-IQ groups was reduced by one; hence N=36, not 45, and (3) all students were given additionally a set of questions to answer without having been presented any information. The additional set of measures were included as a control measure to determine if the students' scores on oral communication differed significantly from scores obtained when they guessed the answers. The "guessing" questions were given at the end of each period on the first day of testing and the beginning of the third day of testing.

With these exceptions the study was conducted in the same manner; the same factors and levels were included in the design; a stratified random sample was taken from the population; the same passages were presented in the same order using the same scheduling procedure specified in Chapter 2.

Initially 45 Ss were included in the study, but due to various school activities the S attrition rate was high. In each of the nine age-IQ groups at least one S missed some testing. As a consequence, the S who missed the most testing in each of the nine groups was dropped from the study. In those few cases where a missing cell value was needed the cell mean was substituted and one degree of freedom was sacrificed for each such substitution.

Sample

Thirty-four of the original 45 Ss sampled were deaf at birth; 14 were deaf as a result of genetic factors and 20 as a result of unknown factors. Six of the Ss were deafened later in life; four before the age of two years and two after the age of two. Five of the Ss did not have the cause of deafness specified in their files.

Of the entire sample all but two students had been at the school for two years or more.

Tables 22, 23, and 24 present statistical data defining the characteristics of the sample drawn from the Michigan population. All the means for these descriptive variables have been calculated on the original sample of 45 so that a more accurate comparison can be made with the Maryland sample.

Because of the similarity in mean values of hearing loss for the nine age-IQ groups between the Michigan and Maryland sample and inasmuch as it was previously determined that hearing loss was not confounded with age and IQ further analysis was not conducted; for the Michigan sample the assumption was made that hearing loss was not a confounding variable.

Results

Testing of the Michigan Ss was conducted as far as possible in the same way Maryland Ss had been tested. The mean length of time for each presentation of material under each method of instruction is presented in Table 25.

Table 22

Means for: Age; IQ; Hearing Loss; and Reading Level for the Sample

Age-IQ Groups	Age in Years	IQ	Hearing Loss	Reading Level
Group-1	12.25	78.80	92.00	1.92
Group-2	12.13	106.00	84.00	2.78
Group-3	12.38	116.20	90.60	2.54
Group-4	14.60	77.40	85.60	1.98
Group-5	15.05	101.80	93.20	3.54
Group-6	14.76	121.20	97.00	3.32
Group-7	18.02	82.20	94.80	2.74
Group-8	16.63	103.20	94.20	4.90
Group-9	16.88	122.00	91.00	4.68

Table 23

Means and Standard Deviations for Each Level of Age and IQ

	Age			IQ		
	A-L	A-M	A-H	IQ-L	IQ-M	IQ-H
Means	12.25 yrs.	14.80 yrs.	17.77 yrs.	79.47	103.67	119.80
S.D.	3.13 mon.	2.76 mon.	8.09 mon.	5.82	4.67	9.36

Table 24

Means and Standard Deviations for the Entire Sample on Hearing Loss, IQ, and Reading Level

	Hearing Loss	IQ	Reading Level
Means	91.38	100.98	3.17
S.D.	9.33	18.95	1.57

Table 25

Mean Length of Time in Which Passages Were Presented for Methods of Communication*

	Oral	T.C.	Manual
Means	3.14 min.	3.58 min.	3.63 min.
S.D.	27.53 sec.	42.27 sec.	28.37 sec.

* Mean and S.D. for reading were not computed because of variability between students in reading time.

The mean number of correct responses and the standard deviations under each method of communication are presented in Table 26. Table 27 presents the grand means for the factors of age and IQ across all levels of communication. It can be observed that the mean number of correct responses under oral communication is conspicuously lower than the other three methods of communication. Likewise, the means for the older group (A-H) and lower IQ group (IQ-L) stand apart from the other two levels on this combined measure of communication skill.

Table 26

Mean Number of Correct Responses And Standard Deviations for Method of Communication

	Oral	T.C.	Manual	Reading
Means	17.33	23.00	23.72	24.86
S.D.	6.08	7.56	8.33	7.59

Table 27

Grand Mean Number of Correct Responses for Levels on Age and IQ

	Age			IQ		
	A-L	A-M	A-H	IQ-L	IQ-M	IQ-H
Means	20.56	19.71	26.42	16.94	25.58	24.17

Main Analysis

In order to test for the statistical significance of the differences between means and possible interaction effects the data were subjected to an analysis of variance. Table 28 presents the sources of variation, the degrees of freedom, the adjusted degrees of freedom, the sum of squares, the mean squares and the F-values.

Table 28

Summary Table for 3 x 3 x 4 Analysis of Variance

Sources of Variation	df	SS	df**	MS	F
Method (M)	3	1,213.91	1	404.64	34.90*
IQ (I)	2	2,064.29	2	1,032.15	10.26*
Age (A)	2	1,280.04	2	640.02	6.36*
A x I	4	101.79	4	25.45	.25
A x M	6	52.90	2	8.82	.76
I x M	6	200.65	2	33.44	2.88
M x A x I	12	293.10	4	24.43	2.11
Ss: A x I	27	2,715.56	27	100.58	
M x Ss: A x I	71	939.19	27	11.59	

* Significant at the .05 level of significance
**Adjusted degrees of freedom

As indicated in Table 28 there was a significant effect due to method of communication, age and intelligence; however, the method by intelligence interaction effect did not reach a statistical level of significance.

The means for the low and high IQ groups are remarkably similar to those means obtained for the same groups in the Maryland study. The middle IQ group scored much better than either the low or high IQ groups. To determine if the middle group scored significantly better than the other two groups the scores of the low, middle and high IQ groups

under oral communication were subjected to a one-way analysis of variance. It can be observed in Table 29 that there was a significant effect attributable to IQ. To determine which means differed significantly, contrasts were constructed on the means for each of the IQ groups, and are reported in Table 30. Alpha was set at .05.

Table 29

One-Way Analysis of Variance Table Comparing IQ Groups under Oral Communication

Source of Variation	df	SS	MS	F
IQ	23	276.50	138.25	4.49*
S: IQ	33	1,015.50	30.78	

* Significant at the .05 level of significance.

Table 30

Contrasts on the Factor of IQ Under Oral Communication

Contrasts	Difference Between Means	Confidence Interval	Decision
$\bar{X}_M - \bar{X}_L$	20.92-14.17=6.75	1.17 to 12.33	Sig.Difference
$\bar{X}_M - \bar{X}_H$	20.92-16.92=4.00	-1.58 to 9.58	No Difference
$\bar{X}_H - \bar{X}_L$	16.92-14.17=2.75	-2.83 to 8.33	No Difference

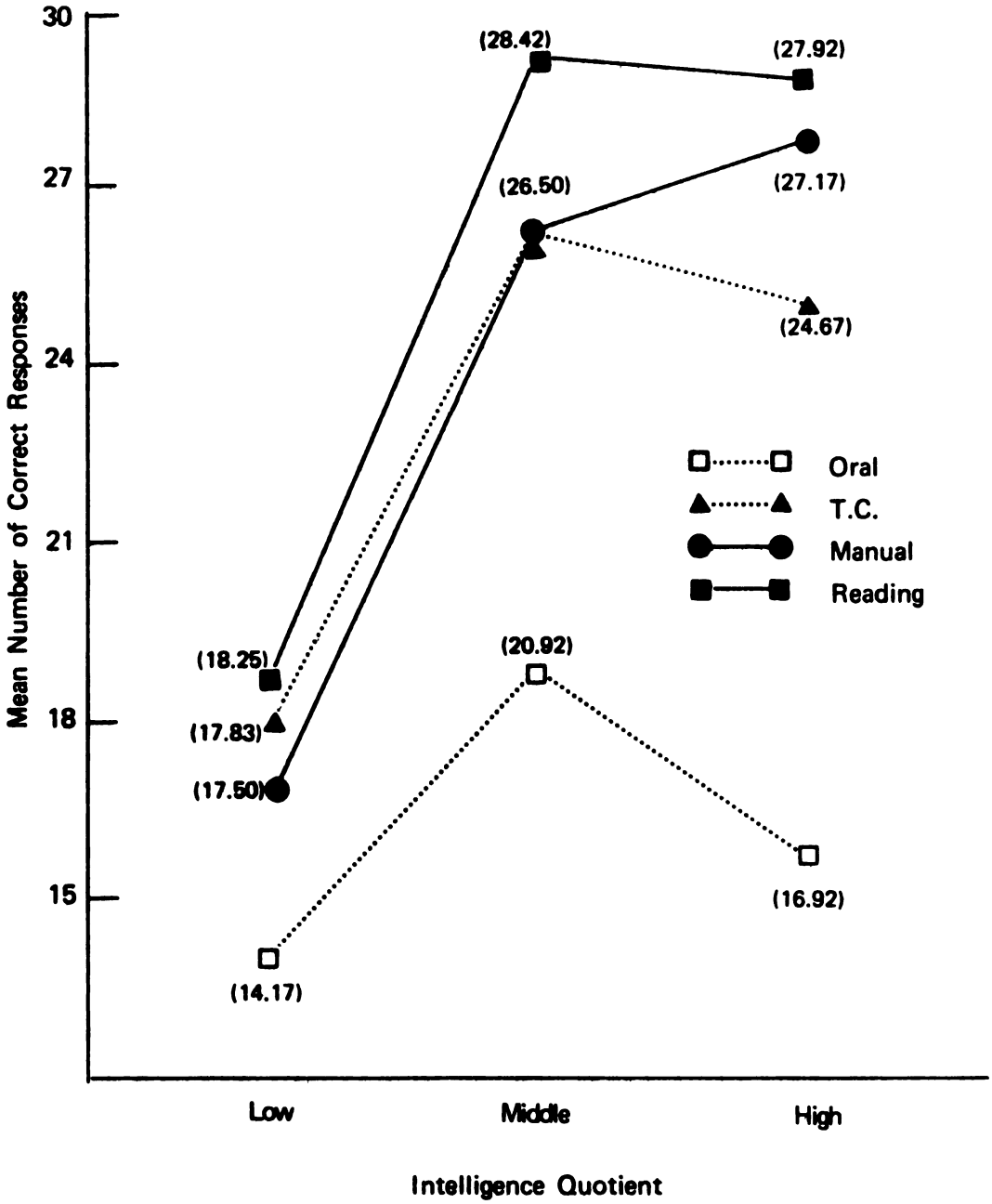

Figure 3

Mean Number of Correct Responses for Low, Middle and High IQ Groups in the Michigan Study

As indicated in Table 30 the only significant difference between the three contrasts comparing IQ groups under oral communication was between the middle and low IQ groups.

Although inspection of the means in Table 26 makes it quite apparent where the significant difference due to method is located, contrasts were constructed on the means for method of communication. The contrasts are presented in Table 31. It is apparent that the oral method of communication differed significantly from total, and manual communication and reading; however, reading, total and manual communication did not differ significantly from each other. Thus it was concluded that Ss in this population of hearing impaired students assimilate significantly more information through total communication, manual communication and reading that they do through oral communication. It was also concluded that there was no significant difference in the Ss ability to assimilate factual information under total communication, manual communication and reading.

Contrasts were also constructed for the grand means on the factors of age and IQ. These contrasts are presented in Tables 32 and 33, respectively. Alpha was set at the .05 level for all contrasts.

Contrasts on the Main Factor of Methods of Communication

Contrasts	Difference Between Means	Confidence Interval	Decision
$\bar{X}_{T.C.} - \bar{X}_{O}$	23.00-17.33=5.67	3.45 to 7.89	Sig.Difference
$\bar{X}_{M} - \bar{X}_{O}$	23.72-17.33=6.39	4.17 to 8.61	Sig.Difference
$\bar{X}_{R} - \bar{X}_{O}$	24.86-17.33=7.53	5.31 to 9.75	Sig.Difference
$\bar{X}_{R} - \bar{X}_{T.C.}$	24.86-23.00=1.86	-.36 to 4.08	No Difference
$\bar{X}_{R} - \bar{X}_{M}$	24.86-23.72=1.14	-1.08 to 3.36	No Difference
$\bar{X}_{M} - \bar{X}_{T.C.}$	23.72-23.00= .72	-1.50 to 2.94	No Difference

Table 32

Contrasts on the Factor of Age

Contrasts	Difference Between Means	Confidence Interval	Decision
$\bar{X}_{H} - \bar{X}_{M}$	26.42-19.71=6.71	2.12 to 11.30	Sig.Difference
$\bar{X}_{H} - \bar{X}_{L}$	26.42-20.56=5.86	1.27 to 10.45	Sig.Difference
$\bar{X}_{L} - \bar{X}_{M}$	20.56-19.71= .85	-3.74 to 5.44	No Difference

Table 33

Contrasts on the Factor of IQ

Contrasts	Difference Between	Confidence Interval	Decision
$\bar{X}_H - \bar{X}_L$	24.17-16.94=7.23	2.64 to 11.82	Sig.Difference
$\bar{X}_M - \bar{X}_H$	25.58-24.17=1.42	-3.17 to 6.01	No Difference
$\bar{X}_M - \bar{X}_L$	25.58-16.94=8.65	4.06 to 13.24	Sig.Difference

From the data in Table 32 it was concluded that the older Ss (Age-H) were able to assimilate significantly more information than the middle and lower age Ss. The lower age and middle age Ss did not differ significantly from each other.

From the data in Table 33 it was concluded that higher IQ Ss and Middle IQ Ss were able to assimilate significantly more information than the lower IQ group. However, the middle and higher IQ groups did not differ significantly from each other.

The over-all mean number of items answered correctly under oral communication in the Maryland study was 15.67. Inasmuch as there were 36 possible, if S answered all questions correctly, and inasmuch as each question was a three-foil multiple choice question it was theoretically possible in terms of probability for S to get a score of 12 (one third of 36) simply by guessing. If S was a

"good" guesser the possibility existed for S to obtain a score slightly higher than 12. However, if the material presented to Ss was difficult a mean score somewhat lower that the chance level (12) would be expected.

In an effort to determine whether Ss were performing significantly better than that expected if they were guessing, they were given two additional sets of questions to answer, but without any prior instruction dealing with the content of the questions. One set of questions (passage 17-B) was given to all Ss at the completion of testing on day-1; the other set of questions (passage 17-D) were given to all Ss prior to testing on day-3. The means for the passages given orally and for guessing are presented in Table 34.

Table 34

Means for Passages Presented Orally and for Questions on Which Subjects Guessed

	Passages					
	8 - Questions			10-Questions		
	17-B*	21-B	22-B	17-D*	19-D	24-D
Means	3.33	3.61	4.33	4.97	4.78	4.56

* Questions on which Ss guessed

To determine if the means for the oral condition and the means for guessing differed significantly from each other the three means based on eight questions were subjected to a

planned comparison analysis (Kirk, 1968; p. 76); the same procedure was carried out in analyzing the data from Table 34 based on ten questions. The results of these analyses are presented in Tables 35 and 36.

Table 35

Analysis of Variance Table Comparing Means On Passages 17-B, 21-B and 22-B by Plannes Comparisons

Source of Variation	df	SS	MS	F
Between groups	2	15.89	-	-
Guessing vs. Oral	1	10.08	10.08	4.25*
Remaining Differences among groups	1	5.81	5.81	
Within groups	105	248.78	2.37	

* Significant at the .05 level

Table 36

Analysis of Variance Table Comparing Means On Passages 17-D, 19-D and 24-D by Planned Comparisons

Source of Variation	df	SS	MS	F	P*
Between groups	2	3.13	-	-	
Guessing vs. Oral	1	2.16	2.16	.43	NS
Remaining Differences among groups	1	1.07	1.07		
Within groups	105				

* Alpha set at .05

From the results of the analysis in Table 35 it can be seen that the Ss did score significantly better under oral communication than they did on guessing for those passages based on eight questions.

The results of the analysis on passages having ten questions (Table 36) reveals there was no significant differences between Ss' performance when guessing and when they had prior instruction through oral communication.

Considering these data together, it appears there is only meager evidence indicating that Ss scored significantly better when they received oral instruction than when they guessed.

If a Type II error has not been made, then the amount of information assimilated under oral communication is questionable. It may well be that many of the Ss did not assimilate anything through oral communication, or at best only a very small proportion of what was said.

Summary of Michigan Study

Based upon the results of the analysis and restricted to the population from which the sample was drawn certain generalizations are possible:

1. Hearing impaired children assimilate more factual information through reading, total communication and manual communication than they do through oral communication.

2. There was no significant difference between reading, total communication and manual communication in facilitating the assimilation of factual information.

3. The speech component in total communication does not significantly increase the amount of factual information assimilated.

4. Hearing impaired children score only slightly better through oral communication than they do through guessing.

5. All categorical sub-groups of hearing impaired children assimilated more information through total and manual communication than they did through oral communication.

6. Ss in the middle IQ group assimilated significantly more factual information through oral communication than the low IQ group; however, the middle and high IQ groups did differ significantly.

CHAPTER V

SUMMARY AND DISCUSSION

The polemic between proponents of oral and manual communication for deaf children has been an active controversy for many years and it is not likely, considering the emotionalism in the field, that it will be resolved very soon.

Obviously, the issue cannot be overlooked because it holds a central place in the philosophy of deaf education. Rather than trying to ignore the controversy or trying to make ubiquitous claims regarding what is best for all deaf children, this study attempted to focus upon two populations of hearing impaired children at two different residential schools, in order to discover the method of communication under which they can assimilate more factual information.

A stratified random sample of 45 Ss was drawn from the Maryland School for the Deaf. Ss ranged in age from 11.0 to 18.7 years and in IQ from 60 to 140. These Ss were presented factual information under four methods of communication: (1) oral communication, (2) total communication, (3) manual communication, and (4) reading. The independent variables in the study were: (1) method of communication, (2) age, and (3) intelligence. The dependent variable was the amount of information assimilated as measured on questions based on the factual information.

It was hypothesized that hearing impaired children would assimilate more factual information when it was presented to them through total communication, manual communication and reading than they would through oral communication. It was hypothesized that there would be an interaction between method of communication and intelligence; the lower IQ Ss assimilating more through manual communication (speech deleted) and the average and bright Ss assimilating more through total communication. It was also hypothesized that hearing impaired children would assimilate more information through reading than they would through oral, total, or manual communication.

An experimental design was used to eliminate criticism directed against the use of ex post facto designs which employ matching techniques. A 3 x 3 x 4 factorial repeated measures design, fixed effects model was used. Ss were presented four passages of factual information under each of the four methods of communication; each S was compared to himself across the four methods of communication. The use of a repeated measures design eliminated the need to match or randomly assign heterogeneous Ss to treatment groups. Four different passages were used with each of the four methods of communication; two of the four passages were at the 2nd grade level of difficulty, and the other two were at the 4th grade level. Equivalent passages

were randomly assigned for use with the four methods of communication.

The same certified interpreter for the deaf was employed to present the material to all Ss under all methods of communication. Information was presented over a three day period, at three different periods each day. "Time of day", "day" and "order of presentation" were eliminated as confounding variables through systematic scheduling.

The results of the analysis of the data suggest the following conclusions: (1) Hearing impaired children assimilate more factual information through reading than they do through oral or total communication; (2) Hearing impaired children assimilate more factual information through total and manual communication than they do through oral communication; (3) All categorical sub-groups of hearing impaired children assimilate significantly more information through total communication and manual communication than they do through oral communication; (4) The speech component in total communication does not significantly increase the amount of information assimilated over what is assimilated through pure-manual communication; (5) Bright, average and low functioning Ss do not differ in their ability to assimilate information under oral communication; however, the average and bright Ss do

significantly better than the low functioning children under total communication, manual communication and reading.

A replication of the Maryland study was conducted at the Michigan School for the Deaf. Three changes were made: (1) a different interpreter was used; (2) the number of Ss was reduced from N=45 to 36; and (3) Ss were given two sets of questions on which to guess to see if guessing scores differed significantly from the mean score under oral communication. The results of this replication suggest the following conclusions: (1) Hearing impaired children assimilate more factual information through total communication, manual communication, and reading than they do through oral communication; (2) There is no difference between total communication, manual communication and reading in facilitating assimilation of factual information; (3) Hearing impaired children score only slightly better through oral communication than they do through guessing; (4) No significant method by IQ interaction was detected; however, the trend in the data clearly supported the results of the Maryland study. The probability of observing the obtained F-value for interaction when there was no effect due to interaction was .10.

In general the results of the replication supported the findings of the Maryland study.

Discussion

Maryland Study

Proponents of total communication have argued strongly that systematic and continual use of total communication would result in greater academic gains for hearing impaired children than would the use of oral-only methods of instruction. Proponents of oral-only instruction strongly disagree with this assertion.

Theoretically, proponents of total communication claim that the sum of the information assimilated through various daily educational experiences across many years of school under total communication would be greater for a specified group of children than the sum of the information assimilated through the same daily educational experiences under oral-only instruction. In other words, if one could expose identical subjects to "N" number of learning experiences over time, under total communication and oral communication, the sum of the information learned under total communication would be greater.

Of course it is impossible to test this proposition directly. It is possible, however, to sample a single educational experience and evaluate what is learned and then send the same children through a nearly identical experience, but using a different method of communication and again evaluating what is learned. If the material used under both experiences was equivalent, obtained

statistical differences would, of course, reflect differences due to method of instruction. Finally, if the experience sampled was representative of the majority of educational experiences which children go through throughout their education, then it would be possible to generalize the outcome of many such experiences, and a hypothesis could be constructed predicting which method would facilitate the acquisition of more information over time. Succinctly stated, it would be very desirable if the cummulative effects of utilization of a method could be predicted, relative to other methods, before children are subjected to that method for the duration of their education.

In this study, an attempt was made to make a reality of the aforementioned theoretical experiment: a typical educational experience was contrived; typical educational material was used; the same children were repeatedly exposed to experiences which were equivalent, insofar as could be determined, except for the method of communication used.

The results of this study reveal that the quantity of information assimilated through total communication was significantly greater than that assimilated through oral communication. Based upon this study then, it is postulated that the sum of many such experiences under total communication would result in the assimilation of

more factual information over time than if oral communication had been used. Assuming there is high correlation between academic achievement and the cumulation of factual information, it is further postulated that at the termination of their school experience, students from the Maryland school will manifest significantly greater academic achievement if instruction is provided through total communication in a systematic and continual fashion, than if instruction were provided through an oral-only approach.

Time and space have been taken to develop this argument because the conclusions drawn, regarding long term educational achievement, are the same as those reached by other researchers using ex post facto designs. However, in one way the conclusion drawn regarding the efficacy of total communication relative to oral communication is somewhat more defensible because an experimental design was used. An experimental design allows for a causational conclusion to be drawn; in this instance it can be said that the addition of signs and fingerspelling increased the assimilation of factual information beyond that assimilated through oral communication.

Thus, there is evidence both from experimental and ex post facto research that hearing impaired children assimilate more information through methods which employ some kind of manual component.

One of the primary purposes in conducting this study was to determine if teachers who fail to use speech in communicating with their students while fingerspelling and using signs deprive those students of information which they might otherwise have received. In other words, does the inclusion of speech in addition to signs and fingerspelling make possible the learning of more information than if the manual components had been used alone? To educators concerned with academic achievement of hearing impaired children this is a crucial issue.

Outstanding proponents of total communication have continually asserted that the use of speech in total communication does indeed communicate to the child more of what is said.

The mean number of correct responses under total communication was actually less than under manual communication, although not significantly lower. The finding of no statistical difference between total and manual communication, and particularly the fact that total communication was lower than manual communication was contrary to what was predicted by the researcher and administrators and teachers at the Maryland School.

How can such findings be interpreted? Two kinds of interpretation can be rendered: (1) a conservative interpretation which would ignore the direction of the results and focus completely upon a statistical interpretation,

or (2) a liberal interpretation which would consider the direction of the results and then speculate about having made a Type II error; that is, having failed to reject the null hypothesis of no difference between manual and total communication.

The only defensible interpretation is, of course, the conservative one. The power of the F-test was .99 which means that there was only one chance out of 100 of failing to detect differences in the population based on differences comparable in size to those observed in the sample.

Taking the conservative approach, it has been concluded that there is no difference between total and manual communication and that the observed difference was a product of chance. Future research might produce results slightly favoring total instead of manual communication. The conservative approach precipitates a single conclusion: the speech component in total communication does not facilitate the assimilation of factual information. If the speech component does not give students additional information beyond that provided through the manual component then it is possible that (1) students do not attend to speech when information is presented through total communication, or (2) the students do attend to speech, but what they receive from this component is purely redundant information.

Another purpose of this study was to determine which method of instruction, --oral, total or manual communication,-- is best suited as a method of communication for different categorical sub-groups of hearing impaired children. As indicated in Chapter 2, nine groups of hearing impaired children were sampled (three age levels crossed with three IQ levels). All nine groups of children did significantly better under total communication and manual communication when compared to the oral method. This ubiquitous observation might well be viewed as a positive outcome of this study, particularly from an administrative point of view. Certainly, knowledge that children in the population learn best under a single mode of communication makes the administrative task of developing an instructional orientation easier.

One of the major findings in the study was the interaction effect between method of instruction and intelligence. As described in Chapter 3 the interaction was ordinal and thus generalizations made in the preceeding paragraph still hold. The nature of the interaction was such that no difference existed between the lower functioning students (IQ-L), the average students (IQ-M) and the bright students (IQ-H) in their ability to assimilate information under the oral method of instruction; however, under total communication, manual communication and reading the average and bright students did significantly better

than their lower functioning peers. This finding indicates that instructing average and higher functioning students using a pure oral method results in a partial negation of their innate intellectual endowment. Stated differently, the average and bright students in this population can function no better than their lower IQ peers when the oral method of instruction is employed.

Such a finding should be given major consideration by administrators and teachers serving hearing impaired children; particularly is this true for those serving children in residential schools because these are the populations to which generalizations may most legitimately be made. Nevertheless, these findings also make it incumbent upon oral educators in the various types of day and residential programs to begin immediately exploring and examining the assimilative abilities of their students when exposed to oral and combined methods of communication. Obviously, oral educators true to their philosophy will resist providing their students with manual skills. Respecting the concern of oral educators not to contaminate their students by manual methods it is recommended that they systematically, and empirically evaluate the ability of low, middle and high IQ students to assimilate information through speechreading.

No significant difference was found between the students' ability to assimilate factual information through

reading and through manual communication. Likewise, there was no significant difference between the students' ability to assimilate information through manual and total communication; however, reading did differ significantly from total communication in facilitating the assimilation of information.

It was concluded that students can assimilate significantly more information through reading than total communication. Regarding the nonsignificant differences between reading and manual communication and manual communication and total communication no conclusion was drawn; rather, it was decided that the best strategy would be to wait and see if additional information from the Michigan study would elucidate these findings.

Michigan Study

The research findings in the Michigan study supported the findings of the Maryland study. Ss assimilated significantly more information through reading, manual communication and total communication than they did through oral communication.

Although no significant method by IQ interaction was detected the results were clearly in the direction of the results observed in the Maryland study (interaction was significant at the .10 level). The difference between the means of the low IQ groups in the Maryland and Michigan study was .70 in favor of the Maryland Ss. The difference between the means of the high IQ groups in both

studies was .92 in favor of the Michigan group. The major difference was in the middle IQ groups; the Michigan group scored 5.32 points better than the Maryland group. When IQ groups at the Michigan school were compared the middle IQ group assimilated significantly more information than the low IQ group.

The Ss in the Michigan study did not differ significantly in their ability to assimilate information under total communication, manual communication and reading. These findings suggest that there is no difference between the amount of information assimilated under these three modes of communication. The latter generalization may not hold, however, when the kind of information being assimilated is significantly altered. For example, if the style of the language is altered, or the complexity of the factual material is increased then differences may be detected between reading, manual communication and total communication. Another restraint upon the above mentioned generalization is that of "rate of presentation". Differences might also be detected if the rate of presentation were significantly increased.

It was also found that the mean number of correct responses for two of the four passages presented through oral communication did not differ significantly from the means obtained through simply guessing. This does not necessarily mean that the Ss received no information from oral communication; however, if they did receive a

significant amount of information the materials used in assessing information assimilated lacked sufficient precision to detect it.

Major Conclusions

In considering the Maryland study and the Michigan study jointly several points can be made. First, it was found that for reading, manual communication, total communication and oral communication the trends were the same; that is, in both studies the means for reading were greater than the means for manual communication and the means for manual communication were greater than the means for total communication. In neither study did reading differ significantly from manual communication. Likewise, in neither study did manual communication differ significantly from total communication. In only the Maryland study was the mean for reading significantly greater than the mean for total communication. In both studies the means for reading, manual and total communication were significantly greater than the means for oral communication. Based upon these finding the following conclusions were drawn:

1. Hearing impaired children can assimilate more factual information through reading, and methods which employ signs and fingerspelling than they can through oral communication alone.

2. The speech component in total communication does not significantly contribute to the assimilation of factual information: the amount of information assimilated in total communication is primarily a function of the effect of signs and fingerspelling.

One should resist the temptation to conclude that there is no difference between students' ability to assimilate information through reading, manual communication and total communication because no statistical differences were found, except for the one between reading and total communication in the Maryland study. Significant differences, among other things, are a function of sample size and precision of the instrument used in assessing the dependent variable. Because the rank order of the means for reading, manual communication, and total communication was the same for both studies it is postulated that by increasing the sample size or the precision of the measurement tool, in future replications, that the relatively small differences observed in these studies would be expanded and the amount of information assimilated through reading, manual communication, and total communication would be found to be significantly different. Based upon this postulate three additional tentative conclusions have been drawn:

3. Hearing impaired children can assimilate more information through reading than they can through manual or total communication.

4. Hearing impaired children can assimilate more information through manual communication than they can through total communication.

5. The interaction of speech with signs and fingerspelling reduces the amount of information which can be assimilated through total communication as compared with manual communication.

Regarding the interaction of IQ and method of communication it was found in the Maryland study that the three IQ groups (low, middle and high) did not differ significantly from each other in their ability to assimilate factual information under oral communication, yet they did differ significantly in their ability to assimilate factual information under total communication, manual communication and reading. The trend in the Michigan study was the same, except for the middle IQ group which did significantly better than the low IQ group under oral communication. Such a finding would not be difficult to interpret if the high IQ group had also scored significantly better than the low IQ group, but no such difference was detected; in fact, the high IQ groups' performance was closer to the low IQ group than it was the middle IQ group. It is possible that in the long run, after many replications with different groups of randomly selected Ss, that the middle IQ group would fall to the level of the other two IQ groups; however, it is also

possible that the high IQ group would score better and more closely approximate the middle IQ group. If the latter situation proved to be the case then it would suggest that both middle and high IQ groups are benefiting more from the oral environment than their lower IQ peers. Although it seems unlikely, it may be that there is something unique to the middle IQ group which allowed them to speechread better than their higher IQ peers.

Such speculation is interesting; however, there is really no way to completely explain this finding without further research with the same or similar residential populations. One broad conclusion can be drawn based upon the results of both studies.

6. Bright hearing impaired children are unable to take full advantage of their innate intellectual endowment in assimilating factual information when that information is presented to them through oral communication.

Implications and Limitations

A major implication of this study relates to linguistic development. In order for children to learn language they must have sufficient exposure to the target language so they can acquire the linguistic rules necessary for generating meaningful and culturally acceptable communication. It is obvious that for a deaf child, simple exposure to oral communication is grossly inadequate. For the deaf child, exposure must mean a quality-quantity

input. Insufficient exposure to the target language (a lack of quantity) and insufficient exposure to syntactic patterns (a lack of quality) leave a deaf child with a very limited means of acquiring the rules by which language is generated.

In stark contrast to speechreading, it appears that the employment of manual methods--in this study, signed English--does provide deaf students with a quality-quantity input. This is a reasonable conclusion inasmuch as language was the medium through which the factual information was transferred from interpreter to students. Furthermore, because language learning is the major social-educational handicap of the deaf child, the findings of this study that hearing impaired children assimilate more information--implicitly, more language--through the use of signs and fingerspelling should be given considerable attention.

In conclusion, it must be remembered that the major goal or objective of most educators of deaf children is twofold: (1) the development of adequate language skills, so that (2) as adults their deaf students will be able to function effectively in society. The development of adequate language skills implies the development of speech skills and the rules of language. Of the latter two skills, knowing and using correctly the rules of our language is by far the most important. Many adult deaf

function very effectively in society without speech, but for those deaf adults who have not acquired the rules of language life can be miserable. Language, not speech, is required to read and write. Without the ability to read and write a very low ceiling is immediately imposed upon deaf adults vocationally.

The kind of factual information presented to Ss in the study might be viewed by some people as a limitation in the study inasmuch as that information is not typical of all types of information presented to students in the course of their education. However, it was felt that the material used was as representative as any material that could have been selected. Furthermore, the communicative process was being investigated not the material itself. The use of different kinds of material should not significantly alter any of the conclusions which have been drawn.

The precision of the instrument used in assessing the amount of information assimilated is a matter of more legitimate concern. Although the questions used were sensitive enough to detect some differences, a larger set of questions with more than three-foil items per question would probably have detected other differences such as those mentioned above regarding reading, manual communication and total communication.

Suggestions for Future Research

Based upon the results of this study, and the design employed, several possible extensions can be suggested:

It is proposed that a study be conducted including "rate of presentation" as a major independent variable. It is important for educators to understand something of the interaction effect between rate of presentation and method of instruction.

It is proposed that a study be conducted which focuses upon the difficulty of material and type of information as major independent variables. It is important for educators to understand the constraints upon reading, total communication and oral communication imposed by the nature of the material being presented.

It is proposed that a study be conducted comparing the effects of the Rochester method with total communication. The time has come to begin focusing upon various combined methods so that the parameters surrounding them can be delineated. (It should be noted that manual communication is not being suggested as a tentative educational method because it ignores speech and speech remains an important goal of all educators.)

It is proposed that a study be conducted which compares the ability of students to assimilate information from teachers with varying degrees of experience and

training with manual skills. In addition, the ability of deaf and hearing teachers to communicate with deaf children should be studied. Answers to the following questions are presently unavailable: (1) What level of manual skill is necessary to achieve an acceptable level of information transfer? (2) Are deaf teachers any more adroit in teaching deaf children than hearing teachers?

Finally, it is proposed that oral educators begin to critically and objectively assess the amount of information their students are able to receive through oral communication. Such evaluation is possible without violation of their educational philosophy. Obviously, if the results of such research reveal that the amount being assimilated is relatively small compared to what was presented, then it is time for a reassessment of the philosophy of education which advocates using a system of communication which fails to communicate.

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APPENDICES

APPENDIX A

Total Communication

Passage 20-B.....Mr. Four Eyes
Passage 24-B.....The Smallest Pets
Passage 21-D.....Voices from the Ocean Floor
Passage 22-D.....Mother Nature's Actors

Code

_____ = a signed word

_____ = a fingerspelled word

( ) = a word that was both signed and fingerspelled

' ' = word inserted by interpreter

UNIT NO. 20 - MR. FOUR (EYES)

Most animals can (get along) with two eyes. With two eyes they can find their food. With two eyes they can keep from becoming food for some other animal. For the Anableps two eyes are not enough. This (fish) has four eyes.

Each of its eyes is really two eyes. The (upper) two eyes can see above the water. These eyes are high in its head. With them the Anableps can see bits of food that might (float) along the (top) of the water.

The (bottom) eyes also help. With them the Anableps can see what is (going on) below the water. If a large fish comes near, the Anableps can see him and swim (away).

Most often the Anableps is about six inches (long). Sometimes it grows somewhat longer. It lives in the fresh water of a far-away land. Much of the time the Anableps is on the (lookout) for (bugs). With so many eyes to see with, it's the bugs who have to look out!

Would you like to catch such a fish? You would have to go a (long way) from home. Even then you might not catch one. People who try to catch Mr. Four Eyes say that it is not easy. "The fish moves away before you can get close," they say. "With four eyes it can't help but see you coming!"

UNIT NO. 24 - THE SMALLEST (PETS)

Some people have (pets) that are very small. They are so small that you have to take a good look to see them. (Hundreds) of them live in just one (glass) house. Can you guess what they are? Do you think they are goldfish? No, they are not goldfish. Do you give up? They are little ants. Ants make very good pets.

Ant pets do not need much (care). They can be given a little honey every other day. A few drops of water must be put in their glass cage from time to time. Ants must be kept out of the sun.

Why don't you get some ant pets of your own? You won't have to go to a pet shop. You can go right out to your garden and find an ant hill. Be sure to get the (queen) ant. She is bigger than the others. You may have to dig down deep to find her.

Put the queen ant in a glass cage with some (dirt). Then put in lots of the other ants. The other ants are called workers.

Keep your eyes on your new pets. They will soon get to work. Each worker ant has a job to do. It is fun to see them make their own homes. They work very hard. They do not stop until they have made an ant city.

UNIT NO. 21 - (VOICES) from the (OCEAN)(FLOOR)

For a long time people thought that the (floor) of the (ocean) was a very (quiet) place. Some thought that it was almost without any (sound). (Scientists) were surprised when they put a microphone under water and heard all kinds of noises. Scientists heard grunts, growls, snarls, and whistles. The bottom of the sea sounded like a zoo. Scientists were puzzled when they found out that these noises were coming from fish.

Fish make these noises by (grinding) their teeth. Others scrape their bones together. Still others make noise with the sac of air in their bodies. Why fish make these noises is somewhat of a (mystery). Some scientists think that the fish use these noises to speak with one another. Most scientists believe that the sounds have no meaning.

Scientists have now found out that the dolphin knows the meaning of some sounds. Tests show that he is one of the smartest animals in the sea. People say that they have been able to teach the dolphin many human words. At Marineland of the Pacific it is said that dolphins have even been taught to sing. They (rise) to the (surface) and sing for visitors. At least it sounds somewhat like singing!

Who knows? Someday scientists may be able to talk with the dolphin and learn many secrets of the sea. Just think of what the dolphin could tell us. We could learn the location of sunken treasure ships. We could learn where to locate great schools of fish. We might even learn the location of enemy submarines.

It could be a thrilling moment when we first begin to find out what those voices from the ocean floor are saying.

UNIT NO. 22 - MOTHER (NATURE'S)(ACTORS)

Have you ever seen Mother Nature's Actors (perform)? If you have, you know that animals often put on a show that is better than anything on television. These animal actors sometimes protect themselves by pretending to be something they are not.

Take the opossum. He is slow and a poor fighter. But when an (enemy) is near he pretends to be dead. He drops to the ground, without moving a muscle. When the enemy leaves, the opossum gets up and goes about his business.

Other animals learn to act for their dinner. A pair of (foxes) will sometimes put on a strange show to catch a woodchuck. One fox walks in front of the woodchuck's den while the other hides nearby. The first fox acts as if he has gone (crazy). He leaps into the air and chases his tail. The woodchuck comes out of his den for a better look. That is what the second fox is waiting for. In a moment the show is over and both foxes are eating dinner.

Nature has given some animals a disguise to help them fool other animals. The sea anemone looks like a beautiful flower. But its lovely "petals" are actually (stingers). When a small fish swims near, the "petals" come to life and (stun) the small fish. Then these same petals shove the fish into the mouth of the anemone.

Perhaps the strangest disguise is that worn by the vine snake. He is long and slim. He (twists) around a limb so that he looks just like a vine. Lizards who climb on this "vine" find to their sorrow that they have been fooled by another one of Mother Nature's Actors.

APPENDIX B

Manual Communication

Passage 18-B Names for Indians
Passage 23-B Little Man in a Pie
Passage 23-D Here Comes the Army
Passage 25-D The Secret of a Snake Charmer

Code

_____ = a signed word

_____ = a fingerspelled word

( ) = a word that was both signed and fingerspelled

' ' = word inserted by interpreter

UNIT NO. 18 - (NAMES) FOR (INDIANS)

How would you like to have (just) a (first)(name)? (Indians) had only first names. They never had last names. Some of their first names were made up of two or three words, like Red Cloud, or (Little)(Bird) Wing. Indians didn't give family names like we do today.

It was a happy day when an Indian baby was named. Many Indians came to see the new baby. Some of them gave long (talks). Everyone ate lots of food. Sometimes they named the baby for something that the father did. Sometimes the name came from something the father saw in a (dream).

Indian children were often (given) nicknames. Some of these nicknames were very (funny), like (Flat Head), Big Teeth, and No Nose. Indian children had to keep their nicknames until they did a great deed. Then they could take a better name. If they did something (brave), they would get new names that told about what they did.

Indians changed their names often. When they got (became) sick, they liked to take another name. When things were not going well, they would change. They thought the new name might change their luck.

When an Indian (died), people in his family would not say his name (anymore). When they talked about the dead person, the Indians would say "my father," or "your friend." The name died with the Indian.

UNIT NO. 23 - LITTLE MAN IN A (PIE)

The (pie) was placed on the table before the (Queen). It was time for the cook to cut the pie in pieces. Out jumped a little man. (Up and down) the table he ran. The Queen liked the joke. She asked to meet the (tiny) man. She wanted to know his name and more about him.

Jeff Hudson was the name of the tiny man. He was (a foot and a half)(high) 'tall'. Jeff was the smallest man the Queen had ever seen. The Queen liked Jeff. She called him Sir Jeffrey. She let Sir Jeffrey stay in the palace.

Life was not easy for Jeff. One time Jeff (fell) in the (wash)(bowl). Jeff could not (swim). He yelled for help. It was lucky for Jeff that a man came by and pulled him out.

Another time Jeff had to run for his life. A (turkey) started to (peck) at him. Around the yard he ran. Little Jeff took many fast (steps), but the turkey was not far behind. Again Jeff was lucky. A man (came along) and (drove) 'chased' the turkey (off).

Jeffrey liked jokes. One time he dressed up like a (kitten). A lady started to feed the kitten. The little kitten looked at her and said, "I can help myself when I am hungry." The lady almost (fellover). The "kitten" (ran out) of the room.

UNIT NO. 23 - HERE COMES THE (ARMY)

Do you know which (animal) is the most (feared) in all of (Africa)? The (elephant)? The (lion)? The (gorilla)? If you chose any of these, you would be wrong. The most feared animal on the continent is much (less) than an inch (long). Yet, every animal in the jungle runs when he is on the (march). He is the army ant.

Millions of these ants (form) an army that is (hundreds) of yards long and many yards wide. Army ants eat nothing but (meat). No animal is too big or too small for them. Even the elephant begins to run when the army ants are on the march. The elephant knows that he must (move) fast. In minutes these little insects can (strip his flesh), leaving only bones behind.

From a distance the ants look like a black carpet moving across the floor of the jungle. Like other armies, the ants have (scouts). These are the ants who run out in front of the army and leave a trail for the others to follow. This trail is a little liquid which the (scouts) carry in their bodies. The army follows this trail. Army ants are almost (blind) and need a (path) to follow.

Both men and animals alike can tell when the army ants are coming. The army (drags) dead meat along. The (smell) (carries)(a long distance). When the natives catch this smell in the air, they know it is time to go into (action).

The natives (release) all their animals. Then they hide in the (brush) until the army ants (pass by).

Even the (bravest) man won't stay around when he learns that the army ants are coming!

UNIT NO. 25 - THE (SECRET) OF A (SNAKE)(CHARMER)

Can you (charm) a deadly (snake) so that it will not bite you? You could, if you knew the secret of the (Indian) snake (charmer). A snake charmer from India keeps his large (cobra) in a (basket). He sits down in front of the (basket) and plays the (flute). As he plays, he (sways) in (time) to the music. Slowly the snake (rises) from the (basket), also (swaying)(from side to side).

Some people say that the snake is not really (dancing) to the music. They point out that snakes do not (hear) (sounds). They say that the snake (moves)(back and forth) so that he can study the snake charmer who is moving (from side to side).

Other people say that the snake is not deadly because the snake charmer has (taken out) his (fangs). In some cases they are right. In many other cases, however, the (cobra) still has his fangs and is able to kill.

A snake charmer sometimes makes (earns) money by getting rid of snakes for home owners. He will go through the house (searching for) snakes. When he finds one, he is paid a small fee. There are those who say that the snake charmer himself puts the snake there in the first place.

Many people in India believe that the snake charmer really has some strange (power) over snakes. Many (visitors)

agree. All will (admit) that no matter how the snake charmer (performs) his feat, he must be (brave). No one can be sure how snakes are charmed. This is the secret of the snake charmer. It's a lot safer to talk about this secret than it is to try to charm a snake. Don't you agree?