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THE UNIVERSITY OF ALBERTA

Factors Affecting Deaf Students' Reading and Language

by

Shirley Papenbrock

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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Date April 14, 1988

Abstract

This study examines the relationship between language and reading scores obtained by hearing impaired students who share a particular background factor and scores obtained by those not sharing that particular background factor. The ten background factors used to group students were age, sex, cause, age at onset, age at diagnosis, language models, intervention, school status, hearing aid use and method of communication. The language and reading scores were those achieved on the Test of Syntactic Ability (T.S.A.) and the Stanford Diagnostic Reading Test (S.D.R.T.).

Eighteen profound prelingually deaf students at the Manitoba School for the Deaf and Govsenor Elementary School in Winnipeg were included in this study. The students were between 9.5 and 11.7 years old. All of the students used the total communication method at school and had hearing parents.

No background factor was found to influence scores consistently on both the T.S.A. and the S.D.R.T.

The scores obtained on the T.S.A. indicated only one significant difference for the background factor of sex, where males scored higher than females. This finding is opposite to the results generally reported in the literature.

The scores obtained on the S.D.R.T. resulted in no significant difference for the word reading subtest. On comprehension the subtest, significant differences were

found for only four factors: cause, where the prenatal rubella group scored lower than those whose hearing loss was not due to rubella; age at diagnosis, where students diagnosed before the age of two scored higher than those who were diagnosed later; intervention, where students who participated in an intervention program scored higher than those who did not; and method of communication, where the oral only group scored higher than the total communication group and the group which used no formal communication method.

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Table of Contents

List of Tables

I. INTRODUCTION

The severe delay of the language and reading abilities of deaf students is a well established phenomenon. Many investigators have demonstrated that the prelingually deaf rarely attain high levels of proficiency in the English language (Conrad, 1979; Myklebust, 1964; Russel, Quigley and Power, 1976).

Deaf students can be grouped on the basis of hearing loss. The degree of hearing loss, when tested in the better ear at 500, 1000 and 2000 Hz, identifies two groups of students: 1) the hard of hearing, who have an average loss of less than 70 dB; and 2) the deaf, who have an average loss of greater than 90 dB. Students whose losses in the better ear are from 71 dB to 90 dB (severe loss) are in the transitional category (Quigley and Kretschmer, 1982). Students who are able to use their residual hearing to process linguistic information when fitted with hearing aids are referred to as the hard of hearing. Others, who have the same hearing loss and wear similar hearing aids but do not use residual hearing, can be referred to as deaf. Although these students do not use residual hearing or wear hearing aids at home, they may wear hearing aids at school because the school requires that they do.

A better understanding of deaf students' low level of proficiency in reading and language can be gained by examining factors which may influence the abilities of the deaf to perform well during reading and language tests.

Factors such as age, degree of hearing loss, cause, age at onset and age at diagnosis are known to affect reading and language scores (Conrad, 1979; Quigley and Kretschmer, 1982). Other factors such as language models, participation in preschool intervention programs (Freeman, Malkin and Hastings, 1975; Levine, 1981), hearing aid use, method of communication and school placement are assumed to affect reading and language scores (Rogers, Leslie, Clarke, Booth and Horvath, 1978). In this study, students were grouped on the basis of ten background factors, and the reading and language scores achieved by these groups were examined in order to determine whether or not there is a relationship between particular background factors and reading and language scores. Four of these factors which may be classified as personal factors are age, sex, cause and age at onset. The remaining factors, which are influenced by the social milieu and parent-child interaction, are age at diagnosis, language models, intervention, hearing aid use, school status, and method of communication.

A. Personal Factors

Generally it has been found that after reaching a grade three reading level, deaf students progress very slowly in reading - approximately .2 of a grade level per year (DiFrancesaca, 1972; Furth, 1966,) and that fewer than 12% of deaf students can read at or above a grade four level at 16 years of age (Conrad, 1979; Myklebust, 1964).

A similar phenomenom arises in language development. Reading and language scores of deaf students increase slowly with age and tend to plateau after age 10 to an approximate rate of .2 grade levels per year (King and Quigley, 1985).

When reading and language scores are compared on the basis of sex, generally no difference is found. There are however slightly more males than females in the deaf population = 54% are males (Quigley and Kretchmer, 1982).

When the loss of hearing is related to prenatal rubella, other handicaps which also affect reading and language ability are frequently present. Another common cause of hearing loss is meningitis, which is usually not accompanied by other handicaps.

When the hearing loss occurs before the age of 3 (prelingually deaf), language development is impaired to a greater degree than if the age at onset is later (Conrad, 1979). This may be expected because some language development would have occurred before the age of 3.

B. Factors Influenced By Social Milieu

Since approximately 90% of deaf students have hearing parents (Schlesinger and Meadow, 1972; Stuckless and Birch, 1966) and vocabulary development is, to a great extent, based on parent-child interactions, normal vocabulary development is difficult for deaf children. Parent-child interactions are severely affected especially if the parents have difficulty accepting their child's handicap.

The lack of acceptance of the hearing loss frequently results in delayed diagnosis and assistance, and the use of only very basic gestural communication (Gregory, 1976; Moores, 1982). Under such conditions, the child may develop severe emotional problems and acquire very limited English vocabulary before entering school (Levine, 1981).

Although parents may accept their child's handicap and earlier diagnosis and assistance is made available, there are still serious barriers to normal communication. Parents must decide between the two approaches toward communication with the deaf, a decision frequently made in the face of conflicting professional opinions and family pressures (Gregory, 1976; Levine, 1981; Moores, 1982). On the one hand, advocates of the oral approach will point out that speech and lip reading are crucial for successful integration with the hearing population, while on the other hand, advocates of the use of sign language will point out that only 5 percent of speech can be lip-read and that manual communication is more important than speech (Vernon and Koh, 1971).

It has been shown that deaf children exposed to an approach using sign language at an early age acquire linguistic competence and have an educational achievement superior to that of their peers educated using an oral approach (Brasel and Quigley, 1977; Stuckless and Birch, 1966; Vernon and Koh, 1971). Children using the oral approach have smaller vocabularies when entering school and

often do not acquire linguistic competence (Holmes and Holmes, 1981; Kretschmer, 1982). Since the first learned and natural language of the deaf is a gestural system (Stokoe, 1972), the choice of the approaches using sign language is thought to be preferable by many authorities. The most prevalent choice today is to use a total communication approach, which includes the use of both sign language and speech, since all possible modes of developing vocabulary are used.

Even when the total communication approach is chosen, vocabulary development continues to be limited by several other factors. (1) Many parents are limited in their ability to sign (Freeman, Malkin, and Hastings, 1975) and consequently communication is usually restricted to short declarative and one-word sentences (Baker and Cokely, 1980). (2) In some cases the child may be isolated due to over protection (Moores, 1982; Schlesinger and Meadow, 1972). (3) Even when parents attend sign-language classes, the emphasis on basic vocabulary prevents the child from having a broader linguistic experience and the benefit of several different language models available to most hearing children. (4) Frequently the language developed at home is a pidgin, incorporating the family's own peculiar signs, and therefore, signed English vocabulary must be relearned upon entering school (Conrad, 1979; Levine, 1981; Quigley and Kretschmer, 1982).

In some cases, when signed English is adequately learned at home, the relearning of language upon entering school is minimized. Since the ability to use signed English is an important skill the child requires to succeed in a special education class in a regular school, the degree to which signed English has been learned before entering school influences the decision as to whether or not a child will be placed in a regular school or be sent to a provincial school.

Silverman-Dresner and Guilfolye (1972) found that, when tested with words common to hearing children aged six to seven, deaf children aged eight to nine could identify only 180 out of 7,300 words. This finding shows that the deaf have a very low formal English vocabulary, but it does not necessarily show a lack of pidgin language vocabulary or experience. For the deaf, English could be viewed as a second language. This view is supported by Hammermeister's (1971) finding that, unlike hearing adults, deaf adults' word reading vocabulary scores on the Stanford Achievement Test (S.A.T.) continued to increase significantly after graduation.

A large vocabulary, however, does not assure reading success for a deaf child. Moores (1970) pointed out that unless a child understands and can use pronouns, prepositions, auxilaries, conjunctions and articles, a written text could not be understood, regardless of the number of vocabulary words known. Because some parts of

speech have no tangible referents, they must be learned formally by deaf children, who are rarely exposed to them through natural interactive communications with adult language models. These parts of speech are used to organize words to form sentences, and since the deaf are usually not exposed to complicated sentences requiring them, comprehension of complicated sentences is difficult. The lack of hearing and of exposure to communication with peers and language models requires that deaf children learn syntax separately, and unfamiliarity with syntax rules makes interpretation of some sentences difficult. For example: "The hunter who shot the bear ran toward the truck" may be interpreted by a deaf student as "The bear ran toward the truck", illustrating that, although the deaf can relate their vocabulary and experience to a sentence, they may not comprehend its true meaning because of a failure to recognize the syntactic structure.

Quigley, Steinkemp, Power and Jones (1978) examined reading and writing errors made by the deaf over a 10 year period and concluded that deaf children could not comprehend material they had read because they could not understand complex sentences due to their limited ability in the use of syntax. Many statements that appeared grammatically correct to the deaf were identified as grossly incorrect by hearing children. Quigley et al. (1978) also found that certain English structures such as the passive tense, which are rarely used by the deaf, were not understood by the majority

of deaf nineteen year olds when they were compared with eight year old hearing children. Quigley and Kretschmer (1982) point out that most traditional reading series have controlled vocabularies, but complex syntax and figurative language occurs frequently at early levels. However, in the case of deaf children, such traditional reading series are not the most appropriate materials to use since it is important to identify and match the children's ability to comprehend syntax with the syntactic complexity of the reading material in order to ensure good comprehension (LaSasso, 1982).

C. The Purpose

The purpose of this study was to examine the relationship between scores obtained by profound prelingually deaf students on language and reading tests and the background factors common to the students tested, in order to determine whether or not some background factors may influence reading and language scores.

D. Objectives

The objectives of this study are to examine the effect, if any, of each of the ten background factors on the scores obtained on the Test of Syntactic Ability (T.S.A.) and the Stanford Diagnostic Reading Test (S.D.R.T.). The 10 background factors are age, sex, cause, age at onset, age at diagnosis, language models, intervention, hearing aid use,

school status and method of communication.

E. Hypotheses

The following ten hypotheses are stated in the form of the null hypothesis.

1. Scores obtained on the T.S.A. Screening Test and the S.D.R.T. word reading and comprehension subtests will not significantly change with age.
2. No significant difference in the T.S.A. and the S.D.R.T. scores will be found when comparing males and females.
3. Students who lost their hearing due to prenatal rubella will not have significantly different T.S.A. and S.D.R.T. test scores than those who lost their hearing due to other causes.
4. Prelingually deaf students who lost their hearing before the age of two will not have significantly different T.S.A. and S.D.R.T. scores than those who lost their hearing after the age of two, but before the age of three.
5. Students diagnosed before the age of two will not have significantly different T.S.A. and S.D.R.T. scores than those diagnosed later.
6. Students who have good language models at home will not obtain significantly different T.S.A. and S.D.R.T. scores than those without such language models.
7. Students who participated in a preschool intervention program will not have significantly different T.S.A. and

S.D.R.T. scores than those who did not participate in such a program.

8. Students who wear hearing aids at home and at school will not obtain significantly different T.S.A. and S.D.R.T. scores than those wearing them at school only.
9. Students who are enrolled in a special education class in a regular school will not obtain significantly different T.S.A. and S.D.R.T. scores than students enrolled at the provincial school for the deaf and living in residence.
10. Students who were exposed to a total communication approach before entering school will not have significantly different T.S.A. and S.D.R.T. scores than students who were exposed to the oral approach only, or students who were exposed to no formal communication approach.

F. Delimitations

1. The sample included students from only one geographic region, that is, those enrolled at the Manitoba School for The Deaf and the Govsenor Elementary School.
2. All students were enrolled in the total communication program.
3. The students' ages ranged from 9.5 to 11.7 years.
4. All the students had hearing parents.
5. All tests were administered and scored by the researcher.

G. Limitations

1. The T.S.A. is normed for American deaf students (90 dB hearing loss or greater) who have no additional handicaps and are aged between 10 and 12 years. Students used in this study were aged between 9.5 and 11.7 years. Five students had additional handicaps with two of these students having less severe hearing losses (less than 90 dB). These handicaps were not severe enough to warrant excluding them from the sample. Although the five students were considered to have perceptual difficulties and emotional or behavioral problems, they were very cooperative and eager to complete the tests. However, the inclusion of the students with handicaps resulted in lower mean test scores.
2. Since the majority of the students were half a year younger than the age norm for the T.S.A., and five of the students had additional handicaps, the statistical validity of the T.S.A. results is questionable and these results are consequently interpreted with caution and presented as describing trends rather than as defining conclusions.
3. The S.D.R.T. is normed for low achieving hearing students, and not for the deaf. Also, the results of this test becomes less reliable when reading scores fall outside the range of grade 1.5 to 3.5.
4. The sample of only 18 students is small. Furthermore,

for some of the analyses, data for particular students was not available due to omissions on the background factors questionnaires. Three questionnaires were not returned and the number of students in most groups was lower than 18.

H. Definitions

1. READING is a receptive communication process using print as a medium.
2. SYNTAX is the way in which words are organized to form grammatical structures such as phrases, clauses or sentences.
3. HEARING IMPAIRMENT is a hearing disability which may range in severity from mild to profound: it includes DEAF and HARD OF HEARING.
   a. A DEAF person is one whose hearing disability precludes successful processing of linguistic information through audition, with or without a hearing aid (Rodda and Grove, 1987).
   b. A HARD OF HEARING person is one who, generally with the use of a hearing aid, has residual hearing sufficient to enable successful processing of linguistic information through audition.
4. HEARING LOSS is defined as follows:
   a. Hearing Threshold: minimum effective sound pressure of a stimulus that is capable of evoking an auditory sensation (unaided in a better ear) broken down as

follows:

- Moderate-severe (56 - 70 dB ISO)
- Severe (71 - 90 dB ISO)
- Profound (91 dB ISO and greater)

b. ISO Calibration: the audiometric standard developed by the International Standards Organization.

5. TOTAL COMMUNICATION is the philosophy incorporating many aspects of communication for the deaf into a single approach which is best suited for a particular individual.
6. SIGNED ENGLISH is a term referring to the various sign language systems based on English language structure.
7. CAUSE is a term used to describe how a hearing loss is acquired. In the group of students used in this study, the most common prenatal cause is rubella whereas the most common postnatal cause is meningitis. In this study, cause refers to whether or not the hearing loss was a result of prenatal rubella.
8. AGE AT ONSET refers to the time at which a hearing loss is incurred.
9. AGE AT DIAGNOSIS refers to the time at which a professional diagnosed the hearing loss.
10. LANGUAGE MODEL refers to a significant individual, such as a parent or a relative who is also deaf, who acts as a model for developing language skills.
11. INTERVENTION refers to an early intervention language program situated in a regional school or hospital

setting, or to a professional becoming involved by teaching sign language to the family.

12. SCHOOL STATUS refers to the type of program in which a student is enrolled such as a special class in a public school or living in residence at a provincial school.

I. Summary

This chapter presents the difficulties deaf students encounter ~~while~~ acquiring reading and language skills, as well as the relationship between ten background factors and deaf students' reading and language abilities as measured by the T.S.A. and the S.D.R.T.

The ten background factors are not independent from one another. The difficulties a deaf child encounters while learning English may originate with the parents' ignorance or lack of acceptance of deafness, which, in turn, may affect when diagnosis occurs, the method of communication used, hearing aid use and the nature of professional intervention. The level of language proficiency reached at home may well determine whether or not the child will be enrolled at a regional center or in a special education class. All of the background factors have been investigated in previous studies with sometimes seemingly contradictory results. The only factor which generally has not been found to affect language and reading scores is sex.

Because of limitations in the choosing of the sample, the sample size, and differences between the characteristics

of students used in this study and those used when establishing norms for the T.S.A., the results are interpreted with caution and presented as describing trends rather than defining conclusions.

Specifically, this study examines the relationship between ten background factors and scores obtained by hearing impaired students on the Test Syntactic Ability and on the Stanford Diagnositic Reading Test.

II. REVIEW OF THE LITERATURE

This chapter is an overview of studies in which the 10 background factors have been investigated. The first four factors, considered to be personal factors, are age, sex, cause, and age at onset of the hearing loss. The remaining six factors, considered to be influenced by social milieu, are age at diagnosis, language models, intervention, hearing aid use, school status, and method of communication. A brief discussion of language theory and how structure and syntax affect language and reading scores follows. Lastly, the limitations of the tests used in this study and students' answering strategies are discussed.

Reading has been defined as a receptive communication process that uses print as a medium. This process depends on the reader's ability to decode visual symbols into meaning. A reader is required to relate what has been read to previous knowledge rather than decoding symbols into speech to obtain meaning (Smith, 1977). Reading comprehension depends on the reader's perception (what a reader is looking for), cognition (what is already known), and language ability (ability to use syntax when the text is complex). Although the process of learning to read follows the same progressive sequence as does learning the spoken form of language for all students including the deaf, deaf students rarely attain the levels of language proficiency necessary for reading (Russell, Quigley and Power, 1976; Levine, 1981; Rodda and Grove, 1987). Surveys of reading

achievement show that deaf students' reading levels are retarded when compared to their hearing peers.

Age

Pugh (1946) was one of the first researchers to report on the reading abilities of the deaf using the Iowa Silent Reading Test and the Durrell-Sullivan Reading Achievement Test. She found that the highest reading level obtained on any subtest was at a grade 6 level and that scores from the vocabulary and sentence meaning subtests leveled off with age. Scores increased slowly with age from the seventh to the thirteenth year of schooling.

Furth (1966) used data on 5,307 hearing impaired students between the ages of 10.5 and 16.5 and found results similar to Pugh's. Students between the ages of 10 and 11 obtained a mean grade score of 2.7 and the grade score increased to 3.5 for students between the ages of 15 and 16. The increase in scores was less than one grade level over a 5 year period of time.

DiFrancesca (1972) found that the scores from the paragraph meaning subtest of the S.A.T. for approximately 17,000 hearing impaired students age 6 to 21 increased only .2 of a grade level per year. Conrad (1979) cited reading studies he conducted in England, Wales, Sweden, Denmark and New Zealand concluding that a low reading ability appears to be a typical characteristic of most deaf students.

Although the studies cited used different tests and procedures, their results were consistent. It was found

that deaf students' reading scores were retarded and tended to level off at the age of 10, while those of hearing students were advanced and continued to increase. The low reading levels of the deaf students seem to indicate an inability to use written language to obtain meaning, a task which requires the adequate development of language skills such as syntactic ability.

Sex

Generally no significant differences in language scores due to sex have been found. However, Brasel and Quigley (1977) found that females of the same age scored higher than males on the negation test of the T.S.A. Females also scored higher than males on the paragraph subtest of the S.A.T.-M.I. (Rogers, Leslie, Clarke, and Horvath, 1978).

Age at Onset

Profound prelingually deaf students were found to obtain lower reading scores on vocabulary, but not on comprehension, than those who suffered the loss after the age of three (Rogers, Leslie, Clarke, Booth and Horvath, 1978). This finding is consistent with the results of other studies as summarized by Conrad (1979).

Cause

The cause of hearing loss was selected as a background factor because it has been reported that as many as 25 percent of the deaf population have one or more additional handicaps (Quigley and Kretschmer, 1982), and when the cause

is related to prenatal rubella, additional handicaps are frequently present.

It has also been found that students whose hearing loss resulted from prenatal rubella scored significantly lower on language and reading tests that other prelingually deaf students with the same hearing loss (Conrad, 1979; Moores, 1982).

Age at Diagnosis

The difficulties a deaf person experiences while learning English begin at a very early age. Since only a small percentage of the population has a hearing impairment and only 1/1000 of the population have profound losses, it is not surprising that parents and doctors are not suspicious of a hearing loss, especially when the child appears perfectly healthy. The average delay between suspicion and confirmation of the hearing impairment is 8.5 months with the majority of the students being diagnosed at the age of two (Freeman, Malkin and Hastings, 1975).

In order for a child to receive professional help and be fitted with hearing aids as early as possible, parents must be made aware of and accept their child's handicap. The importance of prompt diagnosis and intervention can be seen when one considers Burtons's (1983) findings that hearing impaired infants began to babble shortly after receiving a hearing aid, and that such infants followed the same language acquisition stages as hearing children.

Language Models

Regardless of the communication approach used by parents, it has been found that communication exchanges between parents and deaf children are different from those used between parents and hearing children. Gross (1970), who examined deaf children's conversations with their mothers, found that the mothers were less likely to use verbal praise and more likely to show verbal antagonism. They were also found to use less language than parents of hearing children.

It has been found that deaf students with deaf parents scored significantly higher in reading and language than students with hearing parents (Quigley and Frisina, 1961; Stuckless and Birch, 1966; Meadow, 1968). The higher scores were attributed to the natural and continuous use of sign language, which usually does not occur with students who have hearing parents. It has been found that in as few as 8 percent of hearing parents, both parents could sign (Freeman, Malkin, and Hastings, 1975); and that in 22 percent of the cases of hearing parents, only one parent, usually the mother, could sign; and in 27 percent of the cases of hearing parents only the child could sign. Most parents, who are the child's principal language models, were found to prefer talking to signing, with half of these parents using gestures as well.

Gregory (1976) found that 57 percent of the hearing impaired students' parents she studied relied exclusively on

gesture, showing, and pointing, and were not able to explain things to their child. Consequently, in a situation, for example, when the child was in danger, these parents physically moved their child and frequently used punishment instead of communication.

King and Quigley (1985), when examining the communication exchanges between mothers and teachers of hearing impaired children, and when comparing these with exchanges between mothers and teachers of hearing children, found that in the case of the hearing impaired children, the exchanges were rarely initiated by the child and consisted of limited use of language. For example, teachers were found to initiate the exchanges 90 percent of the time.

When parents, students and school administrators are actively involved in a reading program the scores tend to increase regardless of the method of communication used. For example, Lane and Baker (1974) observed that parents, teachers and students expected low reading scores before their study, however, during the study, reading was emphasized at school and at home and the reading scores consequently improved. In four years, the average reading score had increased 2.5 grade levels as compared to the expected .8 of a grade level. This increase in reading scores was attributed to the continuous program and attitudes of the people involved. Similar to Lane and Baker (1974), Serwatka, Hesson and Graham (1984), a resource team who helped teachers, parents and dormitory personnel become

involved in the students' reading program, also found significant increases in reading scores over a three year period of time.

The results from the above studies illustrate the importance of a good reading and language curriculum and involvement of language models.

Intervention

Intervention refers to the sevices and programs offered to parents and their hearing impaired children from the time the hearing impairment is diagnosed until the child reaches school age at six years. Intervention includes diagnosis, the provision and fitting of hearing aids, speech and language development involving audiologists and speech therapists, and counselling and instruction for parents.

Many intervention programs were developed along academic lines and emphasized language development, reflecting a modified version of grade one (Moores, 1982). Moores (1982) reported that children who participated in such a program before school did not perform significantly better in language and reading after they had entered school. The only exception was found when comparing hearing impaired children who had hearing impaired parents, in which case the children of hearing impaired parents scored significantly higher on language and reading tests, as well as in other academic areas.

Burton (1983) introduced a one session per week intervention program for children 1.5 years of age in which

children were encouraged to play with sound. Lip reading was not emphasized before the age of two because children cannot cope with the competing sensory modalities of looking and listening. The exposure to language and sound was increased gradually from once a week to daily by the time the children reached the age of 5. Older children were encouraged to play with hearing students and participate in the same nursery school program. A tutor recorded unfamiliar vocabulary words and language content and then worked with the children and their parents. Students who participated in this program were reported to become orally and linguistically competent.

Hearing Aid Use

Rogers, Leslie, Clarke, Booth and Horvath (1978) found that students who wore hearing aids at home and school obtained significantly higher vocabulary and paragraph meaning scores on the Stanford Achievement Test for the Hearing Impaired (S.A.T.-H.I.) than those who did not wear hearing aids.

Markides (1986) found that when infants were diagnosed early and were fitted with hearing aids before the age of 6 months, 50 percent of the infants were able to speak intelligently by the time they entered school. When hearing aids were fitted during the second six months of life, and at age 2 and 3, very few of the children were rated by their teachers as having intelligible speech when they entered school.

School Status

Rogers, Leslie, Clarke, Booth and Horvath (1978) found that students who were enrolled in a regular or special education class in a public school obtained higher reading and language scores than those students who attended a provincial school for the deaf.

Quigley and Kretschmer (1982) also found that hearing impaired students attending a regular school scored significantly higher on language and reading tests than hearing impaired students with a similar hearing loss attending a school for the deaf.

Method of Communication

The background factor of communication approach used refers to whether the emphasis in early communication was placed on an oral approach or on sign language. The communication approach used in preschool years was found to affect the language and reading scores of deaf students aged 10 to 18 years (Brasel and Quigley, 1977). Brasel and Quigley tested four groups of students: a manual English, an average manual group, an intense oral group and an average oral group using the T.S.A. and the S.A.T. They found that when comparing the manual English group with the oral groups, the manual group scored significantly higher, suggesting that the manual approach may be preferable for deaf students.

In contrast, Rogers, Leslie, Clarke, Booth and Horvath (1978) found that a group using the oral approach scored

significantly higher than a group using the manual approach. However, students used in their study were not all deaf, but included students with a wide range of hearing losses.

White and Stevenson (1975) examined the effects of the total communication, manual communication and oral communication approaches and reading on the learning of factual information. Forty-five hearing impaired students with a greater than 65 dB loss in the better ear, aged 11 to 18.7 years, who had an I.Q. score between 60 to 140, were asked to read passages or watch an interpreter present passages, and to answer a standard set of questions associated with them. The results indicated that reading was a significantly superior method for presenting factual information when compared to the oral and total communication approach. However, no significant difference was found between the manual method and reading, although the reading score was higher. Students in the manual and total communication groups were able to assimilate more information than students in the oral group. This finding lends support to the notion that students using the total communication approach cannot shift their focus from speech to signs without losing some information. The I.Q. scores did not affect the oral students' ability to assimilate information; however, the students with average or above average I.Q. scores could assimilate significantly more information than students with lower I.Q. scores when the information was presented through a total or manual

communication approach or through reading. The results of this study demonstrate that more information is acquired through reading than when using a total communication approach.

Parents frequently do not have much choice as to which method of communication is chosen. Either the oral method or the manual English method is introduced shortly after diagnosis and the method chosen is consistent with the method used at school, the child is more likely to become linguistically competent (Clarke, Rogers, and Booth, 1982; Quigley and Kretschmer, 1982). When parents learned the manual approach in cases when the child was diagnosed at a very early age (3 months), Holmes and Holmes (1981) found that a deaf child had a larger vocabulary of 117 signs than a hearing peer who had an average of 50 words.

Other Factors

The materials used in a program can also affect reading and language scores. LaSasso (1987) found that approximately 80 percent of the 478 programs she surveyed used a basal reader as the primary instructional method or as a supplementary approach to reading. The language experience approach was also used by many programs at all of the school levels. The most frequently used basal series was reported to be the Reading Milestone (Dormac). This reading series has a controlled vocabulary and syntax. It has been designed for profoundly hearing impaired students

aged 6 to 12. However, this series is being used at a high school level. The reading series was developed from studies which show that low comprehension scores are affected by syntax.

Robbins and Hatcher (1981) asked 36 deaf students aged nine to twelve to match a sentence to an appropriate picture. Many of the sentences which were passive rather than active were more difficult to comprehend (Quigley, Montanelli and Wilbur, 1976). Half the students in the study were taught all the vocabulary words in the test sentence before being tested. It was found that word order (syntax) affected reading comprehension, whereas vocabulary did not.

Quigley, Montanelli, and Wilbur (1976) also tested deaf students' comprehension of a passive sentence by asking students to rewrite a passive sentence into an active one. A large number of 18 year old deaf students could not complete this task, and the resulting low score was attributed to the complexity of the syntax.

Chomsky (1965) advocated that the most important component of language is syntax because it permits a person with an infinite amount of knowledge to generate or comprehend an infinite number of sentences. A generated sentence is comprised of a deep structure (the person's idea) and a surface structure (the spoken form of the idea). When both structures occur together in a sentence the sentence is referred to as a kernel sentence. A kernel

sentence consists of a noun phrase and a verb phrase. The simplest kernel sentence contains only a noun and a verb. The noun and the verb form the base for phrase markers. General rules determine the order of the phrases and how the phrases can be extended to produce longer sentences. However, the general rules cannot be applied in cases when irregular verbs, auxilary verbs or negation sentences are used since such cases require specific transformational rules. These rules are used to rewrite the sentence from the deep structure, which contains the semantic component, to the surface structure, which contains the syntactic component. A person who applies only the general rules and does not include the transformational rules would interpret "The hunter who shot the bear ran toward the truck" as "The bear ran toward the truck". This is an example of the application of Chomsky's theory, which maintains that the syntactic component of language gives language meaning.

Although Chomsky's theory of generative grammar focuses on the many ways sentences can be written, grammar is usually taught to deaf students with single sentences. Kernel sentences are taught first and are then extended into longer and more complex ones. This sequence can be found in the current language curriculum for the hearing impaired (Blackwell, Engen, Fischgrund, Zarcadoola, 1978).

Wilbur (1977) found that deaf students do not learn the fundamental noun phrase and verb phrase until the age of 10, whereas hearing students learn this at the age of two.

Quigley, Power, Steinkamp (1977) summarized the results of a six year study of eight common syntactic structures used by 450 deaf students aged 10 to 18 and 60 hearing students, aged 8 to 10. The scores for both groups increased with age and the difficulty of learning various syntactic structures was similar but not identical. The structures that required the least number of rules to transform the deep structure into the surface structure were found to be the least difficult for both groups, whereas, the structures that required more transformations and resulted in changing the order of the subject-verb-object in the surface structure were the most difficult for both groups. The three easiest structures were negation, conjunction, and question formation, whereas the two most difficult structures were relativization and complementation. An example of a relativization sentence is "I helped the student whose father was ill" and an example of a complementation structure is "Sally's hitting the ball surprised Mary."

Quigley, Wilbur, and Montanelli (1976) reported that the most frequently occurring syntactic structures in the Reading for Meaning Series were negation, conjunction, modal verbs and question formation. The order of difficulty of these structures is the same for written or spoken language, and although deaf students are being taught the written and spoken language simultaneously, they do not necessarily apply learned language to sentences found in a reader

(Bryan, 1979).

Maeder (1980) compared the reading performance of two groups of deaf students who were presented with a typical 750 word passage found in a reader or the same passage that had been rewritten with short declarative sentences. When the students' comprehension scores were compared, it was found that the complexity of syntax had no effect on comprehension. This finding suggests that the length of the text has a greater effect on comprehension than the complexity of syntax used in the text. Cumming, Grove, and Rodda (1985) compared the results of forty 12 to 16 year old students' comprehension scores on two rewritten passages that were concrete and abstract and two passages that were concrete and abstract that were not rewritten. The results indicated that the content and level of syntax had no effect on the deaf students' comprehension scores, and that deaf students use the entire text rather than individual sentences for comprehension. This finding suggests that deaf students can bypass the syntactic structures and proceed directly to meaning, a result which is consistent with the findings of Yurkowski and Ewoldt (1986), Gormley and McGill Franzen (1978), and Smith (1975). The results also indicate that reading materials may not have to be rewritten, since the level of syntax does not affect reading comprehension scores.

In summary, the background factors of cause, age at diagnosis, age at onset, hearing aid use, communication

approach used, language models, intervention and school status all have been found to affect language and reading scores. Changes in language and reading scores over time have been found to be insignificant. Sex has usually been found not to have an influence on language and reading scores.

Test Problems

Ewoldt (1982) examined a variety of tests. She reported that answers to a single sentence such as those used in the T.S.A. were more difficult because these sentences were not related to context within a passage. Although the T.S.A. is not a reading test, it has been used in the diagnosis of syntactic errors in language which have been erroneously related to reading difficulties (Wood, 1984). The S.D.R.T. assesses a variety of reading skills. A limitation of this test is that very little context is provided for comprehension. Sometimes the fill-in-the-blank questions may have more than one logical response or may appear syntactically or semantically correct.

Wood, Griffiths, and Webster (1981) found that deaf students who obtained the same reading score as hearing students answered significantly more test questions and made significantly more errors than hearing students in achieving the same reading score. The errors made by the deaf students were consistent, whereas the errors made by the hearing students were not consistent. It was found that the deaf students were using a consistent answering strategy

such as selecting similar words on the basis of common spatial position in the question. A second strategy was to associate a word in the test sentence to an answer word; for example, "Birds are covered with _____ trees/skirts/sky/nests/feathers." The answer selected, which was "nests", may just as easily be associated with birds as "feathers". This strategy inadvertently helped the student answer difficult questions correctly. The second strategy demonstrates that semantics may be used more frequently than syntax by deaf students. However, the fact that deaf students answer more questions than hearing students and that they use a nonlinguistic strategy to answer test questions indicates that standardized reading tests for hearing students are measuring different processes when such tests are given to hearing-impaired students (Wood, 1984). Therefore, reading scores from the Stanford Diagnostic Reading Test may not be valid or reliable when used to assess deaf students.

III. METHODOLOGY

This chapter is a description of the instruments and the sample used in the study as well as the procedures for collection and analysis of data.

A. Description of the Instruments

1. The Test of Syntactic Abilities

Quigley, Steinkamp, Power, and Jones (1978) developed a diagnostic screening test of syntactic ability for profound prelingually deaf children between the ages of 10 and 19. The intent of this test was primarily to help teachers design individualized reading and writing programs. The Test of Syntactic Ability (T.S.A.) is theoretically based on transformational grammar and assesses the use of the more frequently occurring syntactic structures, detecting typical language errors of deaf students.

The T.S.A. consists of 20 individual tests (a screening test and 19 diagnostic tests) which assess nine syntactic structures. A list of the nine syntactic structures progressing from the easiest to the most difficult to learn is as follows: Negation, Conjunction, Determiners, Question Formation, Verb Processes, Pronominalization, Relativization, Complementation and Nominalization. The screening test is comprised of 120 recognition and comprehension questions that were selected from the 19 diagnostic tests. Four types of multiple choice questions

are used to assess a student's syntactic abilities.

The first type of question assesses only the recognition of syntactic structures. Typical questions found on the T.S.A. Screening Test require the student to select a grammatically correct sentence from four choices. An example from the Screening Test of a recognition question for a complementation structure is illustrated below.

A. The children ran home to eat.
B. The children ran home eat.
C. The children ran home até.
D. The children ran home to eating. (p. 5)

The second type of question assesses only the comprehension of the syntactic structures. A student is required to read a sentence and select an answer that best conveys the meaning of that sentence from four choices. An example from the Screening Test of a comprehension question for a syntactic structure such as relativization is as follows:

I found the boy Dad gave the money to.
A. I found the money.
B. The boy gave the money.
C. Dad gave the money.
D. I found Dad. (p. 10)

The third type of question that assesses both recognition and comprehension requires a student to read two sentences and select an answer that best conveys the same message (recognition) or select a sentence that conveys the best meaning (comprehension). The following is an example of a recognition question for a conjunction structure (and):

Tom bought a hat. Tom bought a coat.
A. Tom bought a hat bought a coat.
B. Tom bought a hat Tom bought a coat.
C. Tom bought a hat a coat.
D. Tom bought a hat and a coat. (p. 80)

The following is an example of a comprehension question for a relativization structure (whom):

You waited for the boys. You sent a letter to the boys.

A. You waited for the boys to whom you sent a letter to them.
B. You waited for the boys to whom you sent a letter.
C. You waited for whom you sent a letter to the boys.
D. You waited for the boys to whom you sent a letter to the boys. (p. 11)

The fourth type of question which assesses both recognition and comprehension requires a student to select a word from four choices that would best complete a sentence. The screening test uses this type of question only for the recognition of syntactic structures and not for the comprehension of syntactic structures. An example of a recognition question for a conjunction structure (disjunction) is illustrated below:

I will — walk or ride the bicycle
A. both
B. neither
C. but
D. either (p. 7)

The scores from the screening test are grouped according to the nine syntactic structures. When a score of 80 percent or better is obtained on a syntactic structure, this structure is considered to be learned. If none of the nine syntactic structure scores are above 80 percent the

highest score obtained on a syntactic structure is selected for diagnostic testing.

Each individual test takes 30 minutes to complete. The entire T.S.A. may take up to 10 hours to complete, therefore most educators administer only the screening test and the appropriate diagnostic test.

The first diagnostic test is negation. It consists of 70 multiple choice questions, of which forty-six test the use of negation with a Be verb, Do support, Have verb, or with modals. There are twenty-four negation comprehension questions that use the Be verb and the Do support. The following is an example of a negation recognition question of the contracted modal (should):

> The cat not should chase birds.
> The cat not chase birds.
> The cat no should chase birds.
> The cat should not chase birds. (p. 4)

The following is an example of a negation comprehension question for the uncontracted Be verb (is):

> Mother has a new baby. The baby is not a boy.
> A. The baby is a girl.
> B. Mother does not have a new baby.
> C. The baby is not a girl.
> D. The baby is a boy. (p. 4)

The information obtained from the diagnostic test is helpful for teachers in developing individual language programs.

Norms

The T.S.A. was normed using 411 deaf students between the ages of 10 and 19. They were selected from educational programs for the deaf in the U.S.A. with enrollments of more

than a 100 students. The sample was stratified on the basis of nine geographic regions and day vs residential programs. Selection of students was made on the basis of the following criteria: 1) an average of 90 dB hearing loss in the better ear at 500, 1000, and 2000 Hz; 2) age at onset of hearing loss was before 24 months of age; 3) IQ scores were greater than 80 (WISC-R or WAIS-R); and 4) no disability other than corrected vision was noted.

Norms are presented as age equivalents and percentiles.

Validity

Content validity was established by showing that the tested structures were systematically chosen from the framework of English syntax as described by transformational grammar. Items for the test were selected on the basis of a 10 year pilot study investigating typical errors made by deaf students attempting to use these linguistic structures. Test questions used vocabulary typically found in a grade one reader.

Criterion related validity was established by intercorrelating the T.S.A. with the Stanford Achievement Test (S.A.T.). The intercorrelations ranged from .49 to .76. The correlation between the T.S.A. negation diagnostic test on the one hand and the S.A.T. word meaning subtest and the paragraph meaning subtest on the other hand was .53 and .49 respectively. These correlations are moderately low because the T.S.A. measures only syntactic structures whereas the S.A.T. measures word meaning and comprehension.

Reliability

The internal consistency reliabilities for the 19 diagnostic tests were above .95, with the exception of the first relativization subtest: Comprehension (.94), That-Complements (.94), Infinitives and Gerunds (.94), and Relative Pronouns and Adverbs (.93). The standard error of measurement, which ranged from 2.62 to 3.86, is reported for three age groups (10-12), (13-15), (16-18) on each test.

The reliability coefficient for the negation diagnostic test was .96. Although the reliability of the test was high, the standard error of measurement of 3.5 is large, since scores obtained on this test by deaf students increased very slowly with age. The standard error of measurement is greater than the average annual increase in score for the deaf, making the T.S.A. an inappropriate instrument for measuring changes in language scores of the deaf on an annual basis.

Test-retest reliability coefficients for individual subtests ranged from .63 to .94. The reliability coefficient for the negation test was .71. When this test was administered to Canadian and Australian students, reliability coefficients and mean raw scores were found to be similiar to the American students' norm score (Quigley, Steinkamp, Power and Jones; 1978), indicating that the test remains reliable when administered to English language deaf students in other countries as well.

2. The Stanford Diagnostic Reading Test

The Red Level of the Stanford Diagnostic Reading Test (S.D.R.T.) for grades 1.5 to 3.5 was developed for low achieving readers. This test, which consists of multiple choice questions, was selected for this study because it was felt to be more reliable than the S.A.T.-H.I. since it contains more questions in the vocabulary and comprehension areas. Students are familiarized with test-taking procedures and questions typically found on the S.D.R.T. by starting with a Practice Test. The S.D.R.T. is also criterion referenced, and indicates students' strengths and weaknesses in specific areas.

The word reading subtest consists of forty-two questions which must be completed in ten minutes. The student is required to look at a picture and select an appropriate word that describes the picture. There are three questions related to each picture.

The Reading Comprehension subtest consists of two parts. Part A, which consists of thirty-two questions and must be completed in twenty minutes, requires the student to read a sentence and choose one of three pictures. Part B consists of sixteen questions which must be completed in ten minutes. The student is required to read a sentence and choose one of three words that completes the sentence.

Norms

Using a stratified random sampling technique, 31,000 students were selected from 55 school districts and the sample was stratified on the basis of socio-economic status, school system enrollment, and geographic region. The schools that were selected for norming the S.D.R.T. were requested to administer the test to all of the students enrolled at a particlar grade level. Handicapped students were not excluded from testing.

Norms are given as percentile ranks, stanines, and grade equivalents.

Validity

Content validity was established by showing that the abilities measured by the Red Level subtests and the skill domains of the test reflect the content of reading programs and curriculum materials used in the United States. Therefore, the test measures the fundamental skills thought to be necessary for successful progress in a developmental reading program.

Criterion related validity was established by intercorrelating the subtests of the S.D.R.T. with the corresponding subtests of the S.A.T. These intercorrelations, reported in the S.D.R.T. test manual and ranging from .61 to .95 are as follows: auditory vocabulary (S.D.R.T.) and vocabulary .82, word reading and vocabulary .70, word reading and reading .91, reading comprehension and reading .93, and comprehension total and total reading .95.

Reliability

The internal consistency reliability coefficients for the subtests of the S.D.R.T., as reported in the test manual, ranged from .85 to .98. The coeffcients for the auditory vocabulary, word reading and reading comprehension subtests are .85, .95, and .96 respectively. The internal consistency coefficient for comprehension total is .98 and the standard error of measurement is 3.1. The standard error of measurement for the auditory vocabulary, word reading and reading compehension subtests is 2.3, 2.3 and 2.6, respectively.

The reliabiliy coefficients for the alternate form of the S.D.R.T. ranged from .75 to .94 and the standard error of measurement for raw scores ranged from 2.0 to 3.3.

3. The Questionnaire

A form, consisting of 25 questions requiring short answers or the checking of alternatives, was completed by parents or guardians of the students included in this study. A copy of the questionnaire, which was developed by the researcher, is included in the appendix.

In order to verify the information, answers obtained from the questionnaire were compared with the school records and no inconsistencies were found. Questionnaire information was used to group students for a statistical analysis of the 10 background factors. The 10 background factors are age, sex, cause, age of diagnosis, age at onset,

language models, intervention, school status, hearing aid use, and method of communication.

B. Subjects

The choice of students for this study was restricted to only those students enrolled at the Manitoba School for the Deaf and students in a special education class at the Govsenvor Elemetary School in Winnipeg. All of the students had been enrolled in school for at least two years. All had hearing parents and used the total communication approach. The students' hearing losses ranged from moderately severe (hard of hearing) to profound (deaf). The youngest age group selected for this study (9 to 11 years) was similar in age to the students used to establish the T.S.A. norms.

The ages of students selected ranged from 9.5 to 11.7 years, with 11 of the eighteen students being younger than 10.

The small number of students available required that the 9.5 year old students be included in order to maximize the information available, making the study as meaningful as possible. The limited availability of students and some partially completed questionnaires resulted in very small numbers being included in some groups for the analysis of data.

The number of students grouped according to each background factor is found in Table III.1.

TABLE III.1

The Distribution of Each Background Factor

BACKGROUND FACTORS		n	TOTAL
Age	9 years	11	18
	10+	7	
Sex	Male	8	18
	Female	10	
Cause	Rubella	3	11
	Other	8	
Age at onset	Early	7	12
	Late	5	
Age at diagnosis	0-2 years	8	14
	2+	6	
Language models	Deaf relative	7	15
	None	8	
Intervention	Before school	10	13
	None	3	
School status	Resident	6	11
	Integrated	5	
Hearing aid use	Home and school	10	15
	School only	5	
Method of Communication	Oral only	6	13
	Total communication	4	
	No formal approach	3	

C. The Procedure For Data Collection and Analysis

With the needs of this particular group of students in mind, decoding, which includes auditory discrimination, phonetic analysis and auditory vocabulary, was deleted from the S.D.R.T. Only the word reading subtest and the comprehension subtest scores were used to calculate the total comprehension score. The reliability scores of .95

for the word reading subtest, .95 for the comprehension subtest and .98 for the total comprehension score indicate that each subtest can be used meaningfully on its own. The instructions from the S.D.R.T. were simplified and communicated to the student using the total communication approach to ensure maximum comprehension. Care was taken to ensure that the sign language used by the researcher was consistent with that of the students' teachers. All tests were administered by the researcher at Govsenor Elementary School or at Manitoba School for the Deaf.

Permission to carry out this study was obtained from the principal of the Manitoba School for the Deaf. Consent was obtained from 15 parents or guardians of the students using a consent form which was returned to the school with the completed questionnaire. Three parents who did not return the consent forms were contacted by telephone and consent was obtained. Eighteen students aged 9.5 to 11.7 years, who had hearing parents, were included in the study. The students' hearing losses ranged from moderately severe (hard of hearing) to profound (deaf).

The S.D.R.T. was administered first because its short subtests and practice test familiarized the students with the testing environment. The T.S.A. screening test was then administered and scored, and based on an 80% mastery level, students were then given the appropriate diagnostic tests. With the exception of three students who were tested in the area of conjunction, which includes disjunction and

alternation, students reached a mastery level requiring the administration of only the negation test. Depending on individual needs such as perceptual difficulties and distractibility, some students were tested individually while others were tested in groups of three.

D. The Procedure for Analysis of Data

Analysis

Three of the eighteen students were not required to write the T.S.A. negation diagnostic test because they achieved more than 80% on the negation questions on the screening test.

Students were grouped on the basis of their status with respect to each background factor. Nine of the factors had only two groups and a comparison between group percent scores was made using t-test for small groups with uneven numbers. A mean grade equivalent score was used in the analysis of the S.D.R.T. word reading and reading comprehension subtests. A mean percent score was used in the analysis of the T.S.A. screening test. The number of students placed into groups each background factor was previously presented in Table III.1.

The tenth factor, the method of communication, resulted in three groups and the results were analyzed with an Analysis of Variance. Students were placed into three groups: those using the total communication approach, those using the oral approach and those using no formal approach.

IV. RESULTS AND DISCUSSION

Fifteen of the eighteen questionnaires were returned and the information obtained was used to group scores into the appropriate background factor. Information that could not be obtained from the questionnaire or student records affected the number of students in each group. The missing data introduces error, therefore a comparison of test results with background factors must be interpreted with caution and used only in a descriptive sense.

The analysis of the effects of nine of the ten background factors is presented together in Tables IV.1, IV.2 and IV.3. The remaining factor, method of communication, is treated separately and the results are presented in Tables IV.4, IV.5 and IV.6.

A. Discussion of the Results by Background Factor

Age

Hypothesis 1. The null hypothesis proposed that the scores obtained on the T.S.A. Screening Test and the S.D.R.T. Word Reading and Comprehension subtests will not change significantly with age.

Scores obtained on the T.S.A. Screening Test by the 9 year old group and the 10-11 year old group are presented in Table IV.1. The mean percent score obtained by the older group of students was eight percent higher than the score obtained by the younger group of students; however, this finding is not significant. The small difference between

TABLE IV.1

The Effect of Background Factors On Mean Percent Scores Obtained on the T.S.A. Screening Test

BACKGROUND	FACTORS		$\bar{X}$	SD	t-value
Age	9 years	n=11	35.00	7.31	1.171
	10-11 years	n=7	43.43	22.37	
Sex	Male	n=8	48.38	17.60	3.148*
	Female	n=10	30.20	4.76	
Cause	Rubella	n=3	34.33	9.29	.146
	Other	n=8	35.13	7.74	
Age at onset	Early	n=7	33.86	7.06	.858
	Late	n=5	37.60	7.99	
Age at diagnosis	0-2 years	n=8	32.63	8.73	.992
	2+	n=6	36.67	5.47	
Language models	Deaf relative	n=7	40.86	16.62	1.225
	No	n=8	32.63	8.73	
Intervention	Before school	n=10	33.50	7.34	.565
	None	n=3	36.33	10.69	
School status	Residence	n=6	34.17	5.08	.396
	Integrated	n=5	36.00	9.95	
Hearing aid use	Home & school	n=10	40.10	14.94	1.225
	School only	n=5	31.40	6.62	

* $p < .01$

group scores is not surprising since there is a small difference between the ages of the two groups and the literature states the increase in scores is slow with age (Quigley, Steinkamp, Power and Jones, 1978; and Wilbur, Quigley and Montanelli, 1975). The results of this study indicate that the null hypothesis cannot be rejected.

Scores obtained on the S.D.R.T. word reading subtest are presented in Table IV.2. The score indicates that the 10-11 year old group's word reading score was only .29 of a grade level higher than the scores obtained by the 9 year old group. Generally, scores obtained on the word reading (vocabulary) subtest by both groups are at the same grade level. All of the vocabulary scores were above a grade two level but less than a grade three level. There was no significant difference between the scores obtained by the two age groups, a finding which is consistent with the normative studies. The null hypothesis that the S.D.R.T. word reading scores would not be affected by age cannot be rejected.

Scores obtained on the S.D.R.T. comprehension subtest are presented in Table IV.3.

When the scores obtained on the S.D.R.T. comprehension subtest by the age groups were compared, it was found that there was only a .2 grade level difference between the 9 year old group and the 10-11 year old group. The low reading level and the small increase in scores may indicate

TABLE IV.2

The Effect of Background Factors On Mean Grade Equivalent Scores of the S.D.R.T. Word Reading Subtest

BACKGROUND FACTORS			$\bar{X}$	SD	t-value
Age	9 years	n=11	2.33	.654	.273
	10-11 years	n=7	2.62	.990	
Sex	Male	n=8	2.53	.908	.427
	Female	n=10	2.37	.633	
Cause	Rubella	n=3	2.13	.851	.616
	Other	n=8	2.45	.731	
Age at onset	Early	n=7	2.50	.856	.214
	Late	n=5	2.40	.704	
Age at diagnosis	0-2 years	n=8	2.75	.590	1.733
	2+	n=6	2.13	.745	
Language models	Deaf relative	n=7	2.04	.883	.396
	None	n=8	2.55	.571	
Intervention	Before school	n=10	2.46	.667	.443
	None	n=3	2.27	.874	
School status	Residence	n=6	2.17	.809	.882
	Integrated	n=5	2.52	.409	
Hearing aid use	Home & school	n=10	2.68	.634	1.574
	School only	n=5	2.12	.683	

TABLE IV.3

The Effect of Background Factors On Mean Grade Equivalent Scores of the S.D.R.T. Comprehension Subtest

BACKGROUND	FACTORS		$\bar{X}$	SD	t-value
Age	9 years	n=11	2.00	.362	1.08
	10-11 years	n=7	2.17	.489	
Sex	Male	n=8	2.14	.490	0.90
	Female	n=10	1.96	.353	
Cause	Rubella	n=3	1.63	.322	2.03*
	Other	n=8	1.99	.236	
Age at onset	Early	n=7	1.94	.251	0.28
	Late	n=5	2.51	.485	
Age at diagnosis	0-2 years	n=8	2.16	.177	2.42**
	2+	n=6	1.78	.397	
Language models	Deaf relative	n=7	1.96	.479	0.89
	None	n=8	2.14	.293	
Intervention	Before school	n=10	2.13	.275	2.04*
	None	n=3	1.77	.252	
School status	Residence	n=6	1.88	.355	1.13
	Integrated	n=5	2.09	.323	
Hearing aid use	Home & school	n=10	2.21	.440	1.67
	School only	n=5	1.86	.207	

**p <.05

* p <0.1

that the sample's scores had begun to level off, which would be characteristic of deaf students. A comparison of the grade equivalent scores obtained by the two age groups on the S.D.R.T. comprehension subtest resulted in no significant difference and the null hypothesis cannot be rejected.

Sex

Hypothesis 2. The null hypothesis proposed that no significant difference between scores obtained by males and females on the T.S.A. and the S.D.R.T. will be found.

A comparison of the T.S.A. mean percent scores obtained by students of different sex is presented in Table IV.1. This comparison indicates that males scored significantly higher than females ($p < .01$). In general, the literature reports that the scores obtained by the males and females are similiar, however, when a significant difference has been reported, usually the females scored higher than males, a finding which is opposite to the results of this study (Brasel and Quigley, 1977).

Quigley and Kretschmer (1982) observed that there were typically 46 to 54 percent more males than females in the deaf population, however in this sample, the opposite was true: there were only 8 males and 10 females. Furthermore, 70 percent of the females in this sample belonged to the younger 9 year old group. Although all the students had hearing parents, 60 percent of the females, as compared to only 25 percent of the males, did not have deaf relatives.

When the difference due to sex was investigated further by comparing students within the same age group, the differences still remained significant. The nine year old group scores are as follows: females $\bar{X}$ = 31.71, SD = 4.57, n = 7; males $\bar{X}$ = 40.75, SD = 8.18, n = 4, t = 2.396, $p < .05$. The ten to eleven year group scores are as follows: females $\bar{X}$ = 28, SD = 3.91, n = 4; males $\bar{X}$ = 64, SD = 19.16, n = 3, t = 3.77, $p < .02$. Based on these findings the null hypothesis, that no sigificant difference between scores obtained by males and females on the T.S.A. screening test, can be rejected.

A comparison of the grade equivalent scores obtained by students of different sex on the S.D.R.T. word reading and comprehension subtests is presented in Tables IV.2 and IV.3. The results indicate that there is no significant difference between male and female scores, and the null hypothesis cannot be rejected.

Cause

Hypothesis 3. The null hypothesis proposed that students whose hearing loss was due to prenatal rubella will not have significantly different scores on the T.S.A. and the S.D.R.T. from students whose hearing loss was due to some other cause.

The effect of cause of hearing loss on scores obtained on the T.S.A. and the S.D.R.T. word reading subtest is presented in Tables IV.1 and IV.2. The results show that the rubella group did not have sigificantly different scores

from other students, and the null hypothesis cannot be rejected.

The effect of cause of hearing loss on the grade equivalent score obtained on the S.D.R.T. comprehension subtest is presented in Table IV.3. The results show that the students whose hearing loss was due to prenatal rubella scored significantly lower than the other students ($p < 0.1$) and the null hypothesis can be rejected. The literature reports that students whose hearing loss is caused by prenatal rubella frequently suffer from additional handicaps which influence their reading comprehension scores. The students in the rubella group were known to have perceptual and emotional problems. For example, students in the rubella group were tested individually because they were easily distracted by the presence of others, and they were observed to use what seemed to be a systematic answering strategy, involving the use of an alphabetical sequence or a special pattern when choosing answers. These observations concur with those of Wood, Griffiths, and Webster (1981) who found students using a consistent answering strategy.

Age at Onset

Hypothesis 4. The null hypothesis proposed that prelingually deaf students who lost their hearing before the age of two will not have significantly different T.S.A. and S.D.R.T. scores than the students who lost their hearing after the age of two but before the age of three.

Age at onset was not found to affect the language or reading scores obtained on the T.S.A. or the S.D.R.T. significantly, and the null hypothesis cannot be rejected. This may be due to the fact that all of the students tested had lost their hearing before the age of three. With the exception of one student, all of the students tested were also diagnosed before the age of three.

It is generally accepted that the critical years for acquiring language are before the age of three and most studies investigating this factor use 36 months and under as the age for defining the prelingually deaf. The age of two was selected for this study because the T.S.A. was normed with students who lost their hearing before 24 months of age. That no significant difference was found between students who lost their hearing before 24 months and students who lost their hearing before 36 months is not surprising, since both groups are considered to be prelingually deaf.

Age at Diagnosis

Hypothesis 5. The null hypothesis proposed that students diagnosed before the age of two will not have significantly different T.S.A. and S.D.R.T. scores than those diagnosed later.

A comparison of scores obtained on the T.S.A. screening test and the S.D.R.T. word reading subtest is presented in Tables IV.1 and IV.2 and no significant differences were found. However, there was a significant difference between

the scores of the two groups on the S.D.R.T. comprehension subtest, as presented in Table IV.3.

Students who were diagnosed before the age of two obtained significantly higher reading comprehension scores than students who were diagnosed after the age of two. This finding is consistent with the implications from Burton's (1983) findings that early diagnosis, which results in the early involvement of professionals and intervention programs, is important. Based on this finding the null hypothesis can be rejected.

Language Models

Hypothesis 6. The null hypothesis proposed that students who have good language models will not obtain significantly higher T.S.A. and S.D.R.T. scores than those without good language models.

No significant differences were found between the students who had deaf relatives and those who did not, when comparing the scores that these two groups obtained on the T.S.A. and the S.D.R.T. word reading and comprehension subtests. These scores are presented in Tables IV.1, IV.2 and IV.3. When significant differences due to this factor were found in the literature, the language model was a deaf parent; however, in this study, the language model was a relative, not a parent, and a deaf relative may not be as good a language model as a parent. Based on these findings, the null hypothesis cannot be rejected.

Intervention

Hypothesis 7. The null hypothesis proposed that students who were placed in a preschool intervention program will not have significantly different T.S.A. and S.D.R.T. scores from those who did not participate in such a program.

When comparing the scores obtained on the T.S.A. and the S.D.R.T. word reading subtest by students who were placed in a preschool program with the scores obtained by students who were not placed in such a program, no significant differences were found. These scores are presented in Tables IV.1 and IV.2. However, when comparing the scores obtained by these two groups of students on the S.D.R.T. comprehension subtest, students who participated in an early intervention program scored significantly higher than those who did not ($p < 0.1$). Based on this finding the null hypothesis can be rejected. This finding indicates that the preschool intervention program offered by the Manitoba School for the Deaf benefited those students who participated in it. This finding conflicts with the Moores (1982) investigation, but is consistent with findings of Burton (1983), that intervention programs helped students become linguistically competent.

School Status

Hypothesis 8. The null hypothesis proposed that students who are enrolled in a regular school will not obtain significantly different scores on the S.D.R.T. and the T.S.A. than students enrolled at the provincial school

for the deaf and living in residence. When the scores that these two groups of students obtained on the T.S.A. and S.D.R.T. word reading and comprehension subtests were compared, no significant differences were found. Findings reported in the literature consistently state that students who are integrated in a regular school score significantly higher than those in a residential school. Although the results in this study are not significant, students who were integrated scored higher on all the tests administered. These scores are presented in Tables IV.1, IV.2 and IV.3. These results indicate that the null hypothesis cannot be rejected.

Hearing Aid Use

Hypothesis 9. The null hypothesis proposed that students who wore hearing aids at home and school will not obtain significantly different T.S.A. and S.D.R.T. scores from those who wore them at school only.

A comparison of scores obtained by the two groups on the T.S.A. and the S.D.R.T. word reading and comprehension subtests are presented in Tables IV.1, IV.2 and IV.3. Contrary to the results found by Rogers, Leslie, Clarke, Booth and Horvath (1978), the comparison resulted in no significant difference and the null hypothesis cannot be rejected. It should be noted that students used in the Rogers et al study included those with a wide range of hearing losses. Therefore some students in their study had more hearing than students used in this study. It should

also be noted that although the findings in this study seem contrary to those of the Rogers et al study, a trend is evident, since those who wore hearing aids in this study scored higher on all the test administered.

Method of Communication

Hypothesis 10. The null hypothesis proposed that students who were exposed to a total communication approach before entering school will not have significantly different scores than those students who were exposed to the oral approach only or those students who were exposed to no formal communication approach.

The effects of the method of communication used before starting school on the T.S.A. screening test scores are shown in Table IV.4.

The results from the analysis of variance for the effects of the method of communication on the mean percent scores indicate that there is no significant difference among groups who used a particular communication approach, and the null hypothesis cannot be rejected. This finding suggests that other factors such as peers, teacher-pupil interaction, extra curricular involvement, and school curriculum may have a more immediate influence on language scores.

TABLE IV.4

Results of the Analysis of Variance for the Effects of Method of Communication on Mean Percent Scores Obtained on the T.S.A. Screening Test

GROUP	n	$\bar{X}$	SD	
Oral Only	6	34.17	9.43	
Total Communication	4	36.00	5.23	
No Formal Approach	3	31.67	9.29	
Source		SS	df	F
Between		32.19	2	.2301
Within		699.50	10	
Total		731.69	12	

The effects of the method of communication used before starting school on the S.D.R.T. word reading vocabulary score are shown in Table IV.5.

TABLE IV.5

Results of the Analysis of Variance for the Effects of the Method of Communication on the Mean S.D.R.T. Word Reading Grade Equivalent Scores

GROUP	n	$\bar{X}$	SD	
Oral Only	6	2.5	.271	
Total Communication	4	2.4	.941	
No Formal Approach	3	2.267	.713	
Source		SS	df	F
Between		.1102	2	.1001
Within		5.5067	10	
Total		5.617	12	

The results of the analysis of variance for the effects of the method of communication on mean grade equivalent word reading scores show no significant differences and the null hypothesis cannot be rejected.

The effects of the method of communication used before starting school on the S.D.R.T., comprehension scores are illustrated in Table IV.6.

TABLE IV.6

Results of the Analysis of Variance for the Effects of Method of Communication on Mean S.D.R.T. Comprehension Grade Equivalent Scores

GROUP	n	$\bar{X}$	SD
Oral Only	6	2.217	.157
Total Communication	4	1.7	.224
No Formal Approach	3	1.8	.216

Source	SS	df	F
Between	.7424	2	7.601*
Within	.488	10	
Total	1.23	12	

*p <.01

The results of the analysis of variance for the effects of the method of communication indicate a significant difference. Students who were exposed to the oral approach before starting school scored significantly higher than

students who used a total communication approach or no formal approach. A closer examination of the background factors that are common to all three groups may explain why the oral only group scored significantly higher. The students who used the oral only approach were all diagnosed before the age of two, as only two of the seven students in both the total communication and the no formal approach group combined were diagnosed before the age of two. Five of the six oral only students wore their hearing aids all the time, as compared to only three of the seven students from the other two groups. Those who wore hearing aids also had attended a special language program, whereas only two of the students from the total communication group and one of the no formal approach group attended such a program. Since the age at diagnosis, the use of hearing aids and intervention were common factors to the oral only group, it is inappropriate to attribute the increase in comprehension scores to the early method of communication alone.

Rogers, Leslie, Clarke, Booth and Horvath (1978) found that oral only students scored significantly higher on the word reading and comprehension subtests on the S.A.T.-H.I. However, only the comprehension score was significantly higher here, a finding which may be explained by several factors. Firstly, the sample size used in this study was much smaller than the sample size in the Rogers et al. study. Secondly, Rogers et al. used the S.A.T.-H.I.,

whereas the S.D.R.T, was used in this study. Thirdly, Rogers et al. controlled their groups so that students in any particular group were exposed to only one communication approach both before and after entering school, whereas in this study, students were grouped according to the method of communication used before school only.

B. Summary

The only factor which was observed to have a significant effect on T.S.A. scores was sex, where males scored higher than females.

The four background factors which were found to have a significant effect on comprehension scores, but not on word reading vocabulary scores on the S.D.R.T., were cause, age at diagnosis, intervention, and method of communication. Students whose hearing loss was due to prenatal rubella scored significantly lower on the comprehension subtest than students who lost their hearing as a result of other causes. Students diagnosed before the age of two scored significantly higher than those diagnosed after the age of two. Students involved in a preschool intervention program scored significantly higher on the comprehension subtest than students who did not participate in such a program. Students exposed to the oral only method of communication scored significantly higher than students exposed to the total communication method and students exposed to no formal method.

It was observed that the students who were exposed to the oral only method were the same students who were diagnosed early, participated in an intervention program and wore hearing aids at home and at school.

Generally, the scores obtained on both the T.S.A. and the S.D.R.T. do not differ from the results cited in the literature.

Although the results are presented in the form of conclusive statistical tests, the limitations discussed in the first chapter with respect to the nature of the sample, such as sample size and age, permit the results to be interpreted only as a portrayal of the characteristics of this particular group of students.

C. Implications for Parents and Educators

Parents

In the past, technology for diagnosing a hearing loss was not as refined as it is today. The use of modern technology allows for very early diagnosis. Parents who have reason to believe that their child has a hearing loss as a result of prenatal rubella should be made aware of the technology so that the diagnosis can be made as early as possible. Studies have shown that the fitting of hearing aids on infants before the age of six months greatly enhanced their language development. This stresses the importance of early diagnosis.

It has been shown that the reading comprehension scores of students who participated in an intervention program before school were higher than those of students who did not, indicating that parents should enroll their child in an intervention program whenever possible. Generally, the literature shows that when children are enrolled in intervention programs where parents and other good language models are actively involved, the effectiveness of the program is improved.

In this study, students who were in an intervention program and were exposed to the oral approach in an intense language program were found to have higher reading comprehension scores than those who were exposed to a total communication approach or no formal communication approach. Although the literature generally states that total communication is preferable, the approach selected may be less important than the intensity of the language experience and the involvement of parents and other good language models. The students in this study who were in the oral group also benefited from early diagnosis and the consistent use of hearing aids. Parents should realize that their child will benefit the most if all available resources and professional assistance are used. Their involvement may be the most important factor contributing to their child's success.

Educators

In the past there has been some controversy as to which communication approach is preferable. Educators should be willing to use any method that will improve a child's language and reading skills. In this study, students exposed to the oral approach before school and the total communication approach at school obtained the highest reading comprehension scores. It is important that educators not discount any particular approach, especially if it encourages the involvement of parents and other good language models.

Educators should be aware of the medical history of the child's hearing loss. If the loss was due to prenatal rubella, for example, other handicaps such as diabetes, epilepsy, or heart problems, which also affect a child's ability to learn, may be present. Also, if there was a long delay between the onset of a hearing loss and the diagnosis, the child may have more severely delayed language and reading abilities, and the reason for such a delay should be examined. The cause and any delay in the diagnosis of a hearing loss are important factors for educators to consider when designing special programs.

Many educators believe that the use of standardized test results is the most important component when designing special programs and evaluating a child's abilities. Most standardized tests were originally developed for hearing students and have been modified for the hearing impaired.

However, the rate of learning for hearing impaired students has been shown to be smaller than the standard error of the test, thereby making the test an inappropriate instrument for measuring annual improvement in achievement for the deaf. Furthermore, students in this study and other studies cited were observed to use a systematic answering strategy during testing. A criterion referenced test or checklist may be a more appropriate instrument because the educator must observe particular behaviors in a variety of situations, eliminating the problems introduced by the use of a systematic answering strategy and the interpretation of test scores.

The Stanford Achievement Test for the Hearing Impaired (S.A.T.-H.I.) is the instrument which is most widely used for testing hearing impaired students. It was not chosen for this study because it is a norm-referenced test. Instead, the S.D.R.T. was selected because it is criterion referenced and was therefore felt to be a more appropriate instrument for assessing students functioning at a low academic level, although no other studies in the literature have reported its use with profound prelingually deaf students.

The second instrument used in this study, the T.S.A., is a cumbersome instrument requiring approximately ten hours to administer in its entirety and many more hours to score. Furthermore, to use the results of this test appropriately, the educator must have the necessary theoretical knowledge

of Chomsky's transformational grammar, knowledge which is not common to the average educator.

As with the S.A.T.-H.I., the standard error of measurement of the T.S.A. is greater than the expected annual increase in language scores; and because it consists of multiple choice questions, students can use a systematic answering strategy, making this test an inappropriate instrument for assessing knowledge of basic syntactic operations by the hearing impaired.

A criterion referenced test or checklist provides a more accurate description of a child's abilities and therefore indicates the skills a child must develop in the future. Such results are more useful firstly, for the educator, when designing individual programs and secondly, for parents, when explaining achievement and future educational goals.

Educators should be aware that the findings of this study are generalizable only to the profound preNingually deaf students. Educators should also be aware that the true language and reading abilities of deaf students are very difficult to measure accurately, and scores obtained on reading and language tests should not be interpreted in isolation, but that behaviors and background factors must also be considered.

D. Future Studies

Since the technology for very early diagnosis is available, studies investigating the reasons for a delay in diagnosis and methods of increasing public awareness of the importance of early diagnosis and intervention programs would be beneficial.

Considering that strong language models such as deaf parents are known to have a positive effect on the academic achievement of the deaf, a study investigating whether or not deaf teachers have a more positive effect than hearing teachers on academic achievement would be useful. Further investigations into the effect of programs and activities which involve other good language models would also be useful for educators.

Another worthwhile study may be an investigation into the use of interactive computer programs designed specifically for teaching language and reading skills through the use of absorbing and challenging computer games.

Future studies examining the relationship between language and reading abilities and background factors would produce results which have greater empirical validity than the results of this study, if issues such as sample size, tester reliability, test instruments and questionnaires, and the definition of background factors are taken into account. Results from an improved study would be more generalizable and useful to the deaf community.

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22. Which playschool did your child attend?

    a. an oral/aural playschool

    b. a total communication playschool

    c. a regular playschool

    d. did not attend a playschool

23. Do you read to your deaf child? Yes ——— No ———

24. Has your child attended a summer camp for the deaf?

    Yes ——— No ———

25. Does your child live in residence while he/she attends school? Yes —— No ——