THE EDUCATIONAL PLACEMENT OF HEARING-IMPAIRED CHILDREN

by

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Abstract

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Impaired Children

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The Deafness Management Quotient (DMQ), a scale composed of a set of variables formulated as a guide for the educational placement of hearing-impaired children, was compared with a modified version to evaluate which had greater predictive value. The study was conducted on a retrospective basis by examining subjects' performance in reading comprehension and phonetic speech in order to indicate successful educational placement. The 9- to 11-year-old populations of hearing-impaired children in two English schools for the hearing impaired were tested on each of the variables represented on both quotients. Intellectual Factors and Residual Hearing were the two best predictors of performance on the dependent measures. Family Constellation as a predictor of performance on the reading comprehension tests was the only additional significant variable. Slight overall superiority of the modified DMQ was observed, although this was probably due to the increased significance of the Residual Hearing variable on the modified DMQ. Of the four variables added to the modified DMQ, only Linguistic Differences emerged as a significant predictor of performance on the phonetic speech evaluation. It was concluded that the construct validity of the DMQ and its modified version was limited since so few of the variables were significant predictors. Disadvantages of predictive scales were noted and an alternative parent-infant habilitation program was discussed.

Sommaire

Le Classement Académique des

Enfants Déficients-Auditifs

Joyce Svarc

Le Quotient Éducatif des Déficients-Auditifs (QEDA), une échelle composée d'un groupe de variables servant de guide pour le classement académique des enfants déficients-auditifs fut comparé avec une version modifiée afin d'évaluer laquelle des deux échelles démontrait le plus grand pouvoir de prédiction. Cette étude rétrospective examinait la corrélation entre les prédictions des échelles et la performance réelle des sujets en comprehension de texte écrit et en langage phonétique. Les tests portant sur chacune des variables représentées par les deux quotients furent effectués sur une population d'enfants de 9 à 11 ans de deux écoles anglaises pour enfants déficients-auditifs. De toutes les variables indépendantes, les données intellectuelles et la capacité auditive avaient le plus grand pouvoir de prédiction sur la performance des sujets au niveau des variables dépendantes. Le support familial était la seule autre variable indépendante qui pouvait prédire, de facon significative, la performance dans les tests de compréhension de texte écrit. Nous avons observé une légère supériorité au niveau du QEDA modifié; toutefois celle-ci est probablement dûe au fait que la capacité auditive était une variable plus significative dans la version modifiée du QEDA. Des quatre variables additionnelles du QEDA modifié, seules les différences linguistiques pouvaient prédire, de façon significative, la performance sur l'évaluation phonétique du langage. Nous pouvons conclure que la validité du QEDA et de sa version modifiée est limitée puisque très peu de variables démontrent un pouvoir de prédiction significatif. Les

désavantages des échelles de prédiction sont notés, et une solution alternative est discutée, c'est-à-dire un programme d'adaptation auditive pour parent-enfant.

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Chapter I

INTRODUCTION AND REVIEW OF THE LITERATURE

The problem examined by the current investigation was the appropriate educational placement of hearing-impaired children. Far too often, this critical decision is made by proponents of various types of educational approaches for the hearing impaired who maintain that one particular educational system is more suitable than any other for most hearing-impaired children. These educators fail to take the needs of the individual hearing-impaired child into consideration. In an attempt to address this problem, Downs (1974) conceived of a scale called the Deafness Management Quotient which was designed to individually identify at an early age those hearing-impaired children for whom one particular educational approach was more suitable than another. The present study examined the predictive ability of the original Deafness Management Quotient as well as a modified version based on it, using retrospective data. Achievement in reading comprehension and speech were selected as measures of educational success since they are known to be linguistic skills that are difficult to acquire for most hearing-impaired children.

To understand the context of this study, the review of the literature will be restricted to: (a) general information concerning hearing loss; (b) the educational status of hearing-impaired children; (c) factors which influence the educational potential of hearing-impaired children; and (d) the educational placement of hearing-impaired children.

General Information Concerning Hearing Loss

Hearing

The process of hearing basically involves incoming sound stimuli via the outer ear, transmission through the middle ear, encoding in the inner ear, electricial transmission along the eighth cranial nerve and intracerebral pathways and decoding in the cerebral cortex. The stimuli received in the brain are then processed and related in meaningful patterns with previous experiences. After processing, that which was heard is stored and recalled when necessary. Other important aspects of hearing include the ability to discriminate pitch, figure-ground patterns, the sequence of auditory events and the capacity to process information with sufficient rapidity to keep pace with ongoing experiences such as conversations or learning situations (Hardy, 1975).

The Measurement of Hearing

Hearing is measured by employing an instrument called an audiometer that produces pure tones of various frequencies and intensities (Weaver & Downs, 1972). The individual's threshold for hearing the pure tones at each frequency is charted on a graph called an audiogram (see Figure 1). The unit of measurement used in determining the hearing level is the decibel (dB) represented on both outer vertical lines of the audiogram. A decibel is the smallest change in loudness perceivable by the human ear (House, Linthicum & Johnson, 1964). Rather than increasing by an arithmetic progression, the decibel scale increases by a logarithmic one. Thus, a few decibels will make a significant difference in the ability to hear when a hearing loss is greater than 20 dB. The frequencies tested include 250 Hz and the octave intervals of 500, 1,000, 2,000, 4,000, and 8,000 Hz.

Figure 1

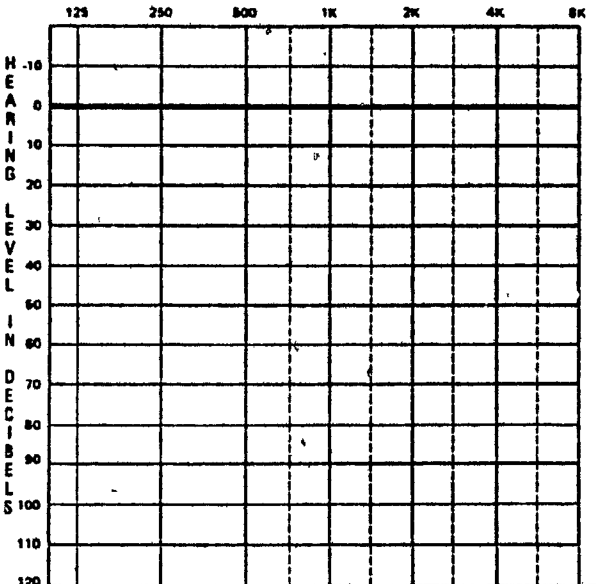
A Typical Audiogram Form

AUDIOLOGIC EVALUATION

FORM 712067

REFERRING DOCTOR	DATE

RIGHT EAR



SYMBOL KEY

O AIR CONDUCTION
● MASKED AC
△ BONE CONDUCTION
▲ MASKED BC
R STAPEDIAL REFLEX
W LOUDNESS DISCOMFORT LEVEL

RE: ANSI 1970

AUDIOMETER

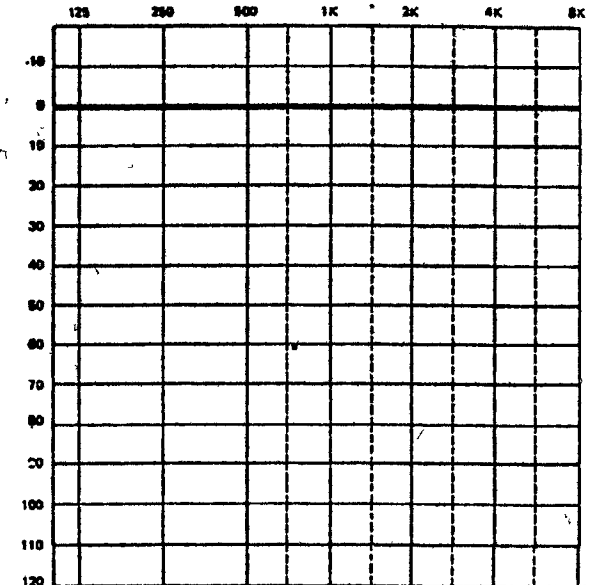
PATIENT RELIABILITY

GOOD ☐
AVERAGE ☐
POOR ☐

SPEECH DISCRIM.

TAPE ☐ LIVE ☐
ENG. ☐ FR. ☐
25 ☐ 50 ☐

LEFT EAR



FREQUENCY IN HERTZ (HZ)

		250	500	1K	2K	4K	8K
MASKING LE (dB)	AC						
	BC						

		250	500	1K	2K	4K	8K
MASKING RE (dB)	AC						
	BC						

TONE DECAY (dB)	
4K HZ	
2K HZ	

SRT	COMFORT LEVEL	DISCRIMINATION QUIET	DISCRIMINATION NOISE	LOUDNESS DISCOMFORT LEVEL	SPEECH	SRT	COMFORT LEVEL	DISCRIMINATION QUIET	DISCRIMINATION NOISE	LOUDNESS DISCOMFORT LEVEL
					RESULT / MASKING					

TONE DECAY (dB)	
4K HZ	
2K HZ	

IMPEDANCE

NORMAL ☐ ABNORMAL ____	TYMPANOGRAM	NORMAL ☐ ABNORMAL ____
NORMAL ☐ ELEVATED ☐ ABSENT ☐	STAPEDIAL REFLEX	NORMAL ☐ ELEVATED ☐ ABSENT ☐
ABSENT ☐ PRESENT ____	REFLEX DECAY	ABSENT ☐ PRESENT ____

Signature ____________________
AUDIOLOGIST/TECHNICIAN

The frequency levels are represented along the top of the audiogram horizontally. The zero dB line indicates the statistical average normal hearing at all frequencies while 100 dB of intensity means a total loss of hearing at all frequencies.

Two kinds of hearing tests are usually performed, air conduction and bone conduction tests (Weaver & Downs, 1972). Air conduction testing is accomplished by placing an oscillator-driven earphone over the external ear. A threshold of response is then determined for the various frequencies at different levels of intensity. The air conduction test yields a measure of the entire auditory system. Therefore, this test indicates the total amount of hearing loss without reference to the site of pathology. Bone conduction testing, on the other hand, requires the audiologist to place an oscillator on the patient's skull right behind the ear and set it into vibration. The inner ear in this case is stimulated directly, having bypassed the middle ear transducers. Therefore, the bone conduction threshold reflects the function of the inner ear and the structures central to it.

The important frequency range for hearing speech is from 500-2000 Hz (House et al., 1964). The loss in decibels at the three speech frequencies (500, 1,000 and 2,000 Hz) is usually averaged in order to tabulate the degree of hearing impairment. When the hearing loss averages 15 dB or less at the three speech frequencies, the individual's hearing is judged to be "essentially normal." A loss greater than 15 dB means that the person will begin to have some difficulty understanding speech.

The Effects of Various Degress of Hearing Loss

Communication difficulties are related to the severity of the hearing impairment as expressed in decibels (Silverman, 1963). The following is a summary of the effects of varying degrees of hearing loss described by the Government of Quebec, Ministry of Social Affairs (1977):

Classification according to severity of hearing loss

- Audition dans les limites de la normale: audition dont la moyenne des seuils audiométriques pour les fréquences 500, 1,000 et 2,000 Hz n'est pas supérieure a 25 dB ISO*, pourvu qu'il n'éxiste pas d'écart supérieur à 10 dB entre la conduction aérienne (CA) et la conduction osseuse (CO).
- Baisse d'audition légère: différence de 15 dB ou plus entre les seuils de conduction osseuse et les seuils de conduction aérienne lorsque ces derniers ne sont pas supérieurs à 25 dB ISO.
- Surdité légère: audition dont la moyenne des seuils en CA se situe entre 26 et 40 dB ISO. Implications: difficulté à entendre la parole à faible intensité. Difficultés dans l'apprentissage scolaire et possibilité d'un léger déficit verbal lorsque la surdité est chronique.
- Surdité moderée: audition dont la moyenne des seuils en CA se situe entre 41 et 55 dB ISO. Implications: difficulté à entendre la parole à intensité normale. Les problèmes psychologiques sont mesurables. Début d'un handicap social substantiel. Amplification par la prothèse nécessaire pour un apprentissage adéquat.

*ISO - International Organization for Standardization

- Surdité modérément sévère: audition dont la moyenne des seuils en CA se situe entre 56 et 70 dB ISO. Implications: difficultés fréquentes même lorsque l'interlocuteur parle fort. Amplification par la prothèse necessaire sous risques de retards pédagogiques importants. Possibilité des problèmes psychologiques et sociaux.
- Surdité sévère: audition dont la moyenne des seuils en CA se situe entre 71 et 90 dB ISO: ne comprend que la voix criée ou amplifiée. L'enfant sourd qui n'a pas eu d'éxperience pré-linguistique sera substantiellement retardé. Fréquents problèmes psychologiques et sociaux.
- Surdité profonde: audition dont la moyenne des seuils en CA est supérieure à 90 dB ISO: ordinairement ne peut comprende même la voix amplifiée. L'enfant sourd qui n'a pas eu d'expérience pré-linguistique sera substantiellement retardé dans son éducation. Problèmes émotifs et psycho-sociaux.
- Surdité totale: abolition complète de l'audition.

Types of Hearing Loss

The relation between the air conduction and the bone conduction thresholds establishes the hearing loss as conductive, sensorineural, or mixed (House et al., 1964).

Conductive hearing loss. A conductive loss of hearing will occur when a barrier to sound is present in the outer or middle ear (Martin, 1975). The inner ear may be intact but the sound will not reach it at normal loudness levels. Such impaired air conduction with normal bone conduction is called a conductive hearing loss. If the person with a pure conductive loss is able to understand sounds, his hearing loss can be overcome by increasing the intensity of the sound (Whetnall & Fry, 1971).

Cochlear sensorineural hearing loss. A sensorineural loss refers to the condition where the loss of hearing function is a result of damage to the inner ear or along the nerve pathway from the inner ear to the brainstem (Berg, 1976). In other words, sound is conducted normally to the inner ear, but its analysis or perception is somehow damaged. With a sensorineural hearing loss, hearing is usually better in the lower frequencies (Whetnall & Fry, 1971). Background noise can exacerbate the hearing loss by masking some of the higher frequencies which are necessary for discriminations between consonants. A sensorineural loss is usually further complicated by an intolerance of loudness. In audiometric terms, the air conduction and bone conduction thresholds are approximately the same with a sensorineural loss (Weaver & Downs, 1972).

Mixed hearing loss. When both a conductive and a sensorineural loss occur together, the result is a mixed hearing loss (Weaver & Downs, 1972). A person with such an impairment shows some loss by bone conduction and a greater loss by air conduction. Congenital mixed hearing losses occur when both the outer or middle ear as well as the inner ear are affected (Whetnall & Fry, 1971).

Incidence of Hearing Impairment

Since no census studies of the hearing-impaired population of Canada have been conducted, all data in the following section represent United States incidence figures. Generally speaking, bilateral hearing losses are found in about 8 per 1,000 children between the ages of 6 and 16, while profound hearing impairments are found in 2 per 1,000 children of the same age group in the United States of America (Catlin, 1977). Prevalence data indicate that profound hearing losses tend to occur early in life; about 50% in the first year of life (Catlin, 1977). On the other hand, the prevalence of less severe hearing losses shows a gradual increase with age until the sixth decade of life is reached.

In order to determine the incidence of deafness more precisely, a definition of this term had to be adopted. The National Association of the Deaf accepted the following definition: "All non-institutionalized residents of the United States who have lost or never had the ability to hear and understand speech, even when amplified, this loss having been suffered prior to 19 years of age" (Schein & Delk, 1974, p. 2). The population described by this definition served as the basis for the National Census of the Deaf Population (NCDP) of 1971 (Catlin, 1977), and included prelingual, perilingual and postlingual hearing losses (hearing impairments occuring before, during and after the acquisition of language comprehension and use). Table 1 records the prevalence rates for hearing impairments as reported by Schein and Delk (1974).

Insert Table 1 about here

The figure for total hearing impairments was about 6.6%. Of this group, half had difficulties in both ears. About 13% of the hearing-impaired group (0.87% of the population) indicated that they could not hear and understand speech. When the latter group was subdivided by age at onset, about 25% fell into the prevocational category (hearing ability lost before 19 years of age) and 11.4% in the prelingual category (hearing ability lost before 3 years of age). The National Census of the Deaf Population Survey of 1971 estimated the prevalence of hearing impairment in the United States prior to the age of 19 at 2 per 1,000, or more precisely, 203 per 100,000

Table 1

Prevalence and Prevalence Rates for Hearing Impairments in the Civilian Noninstitutionalized Population, by Degree and Age at Onset

Degree	Age at Onset	Number	Rate Per 100,000
All hearing impairments[a]	All ages	13,362,842	6,603
Significant bilateral[b]	All ages	6,548,842	3,236
Deafness[c]	All ages	1,767,046	873
	Prevocational[d]	410,522	203
	Prelingual[e]	201,626	100

[a]All persons who responded in an interview that they "had trouble hearing in one or both ears."

[b]All persons who responded in an interview that they "had trouble hearing in both ears."

[c]Those who indicated that they could not hear and understand speech.

[d]Those who lost their hearing before 19 years of age.

[e]Those who lost their hearing before 3 years of age.

Note. Schein and Delk, 1974, p. 16.

(Schein & Delk, 1974). The current rate for all ages was 873 per 100,000 (Catlin, 1977).

Data from the National Census of the Deaf Population of 1971 also indicated that almost 75% of hearing-impaired individuals under the age of 19 lost their hearing before the development of language, before the age of 3. More than 50% lost their hearing before 1 year of age. On the other hand, about 12% developed their hearing impairment at or after 6 years of age. Prevalence figures also demonstrated an increased incidence of hearing impairment during the last 40 years (Catlin, 1975). Decreased infant mortality, medical advances and the rubella epidemic of 1963-64 may account for this trend.

Etiology of Prelingual Hearing Losses in Children

The causes of hearing loss can be grouped into two categories; (a) those which are hereditary and originate in the genetic material received by the embryo; and (b) damage which is acquired during pregnancy or perinatally, during delivery or during the neonatal period (Hardy, 1975). The defects that are acquired are a result of abnormal developmental patterns of injury from infection, anoxia, hyperbilirubinemia, drugs and possibly noise from prolonged exposure to noisy incubation motors. A summary of the causes of congenital deafness is presented in Table 2.

Insert Table 2 about here

The population distribution of children with congenital hearing loss according to etiology is unclear since the causes of many cases are unknown. As the epidemiology of the genetic abnormalities and infectious agents becomes better documented, it can be expected that these two groups will account for many of the cases currently described as "etiology unknown" (Hardy, 1975).

Table 2

Classification of the Etiology of Hearing Impairment

I. Prenatal

- A. 1. Hereditary { Dominant / Recessive
  - 2. Familial
- B. Non-hereditary:
  - Maternal infection, especially virus diseases:
    - rubella — glandular fever
    - influenza — Asian influenza
  - Maternal nutritional deficiencies:
    - the malabsorption syndrome
    - beri-beri — diabetes
  - Drugs and chemicals:
    - streptomycin — quinine
    - salicylates — thalidomide
  - Toxæmia of pregnancy
  - Endocrine--cretinism

II. Perinatal

- Anoxia
- Birth injuries
- Hæmolytic disease, due usually to Rh incompatibility--kernicterus
- Prematurity

III. Postnatal

- General infections, virus and bacterial:
  - mumps — measles — other specific fevers
  - tuberculous meningitis
  - meningococcal and pneumococcal meningitis
  - encephalitis
- Otitis media
- Trauma
- Ototoxic antibiotics: streptomycin — neomycin — kanamycin

Note. From Whetnall and Fry, 1971, p. 95.

Hearing Aids

The purpose of hearing aids is to provide the hearing impaired individual with the ability to perceive the sounds which a hearing loss makes inaudible (Carhart, 1975). Every hearing aid consists of three main components: the microphone, which detects the sound and converts it into electrical energy, the amplifier, which increases the intensity of the signal that was received, and the receiver, which converts the electrical energy back into sound (Ling & Ling, 1978). Each component has become increasingly improved and miniaturized as technology has advanced.

General characteristics of hearing aids. The primary purpose of a hearing aid is to provide the listener with sufficient acoustic cues with which to develop/or maintain the ability to perceive speech (Schwartz & Larson, 1977). Three important acoustic parameters of hearing aids are acoustic gain, frequency range and output.

The acoustic gain of the aid, measured in decibels, is defined as the amount by which a hearing aid increases the intensity of a sound (Ling & Ling, 1978). Gain may be measured at 1,000 Hz, the approximate center frequency of speech at the three frequencies 1,000, 1,600 and 2,500 Hz (the average high frequency gain) or at the point in the frequency range where it provides most amplification (Teder, 1980). Hearing aids are fitted with a volume control to vary the gain over a given range.

The frequency range of a hearing aid is normally calculated by referring to a chart which demonstrates the aid's frequency response; that is, its gain at various frequencies (Ling & Ling, 1978). With the child developing language, the main objective is to select a hearing aid with the broadest frequency range that will provide speech information at a sensation level allowing the child to perceive as many phonemic elements of speech as possible (Ling, 1975a).

The gain of an aid should be distinguished from its output. The output is the addition of the intensity of the sound reaching the aid plus the gain of the aid (Ling, 1975a). That is, Output = Input + Gain. To permit output levels to remain fairly stable when input levels fluctuate widely, and to ensure that output does not become uncomfortably loud, many hearing aids are equipped with circuits that provide some form of automatic gain and automatic output limiting controls (Ling, 1975a).

Binaural versus monaural fittings. Downs (1981) claimed that binaural (aids on both ears) hearing aid fitting should be the fitting of choice in 99% of the cases, the only two exceptions being: (a) when it is absolutely certain that one ear has no usable hearing whatsoever; and (b) in the very unusual case where it becomes apparent after an adequate trial with two aids that the child hears better with one aid than with two.

Types of hearing aids. Hearing aids can be worn either on the body and are referred to as "body-type" hearing aids or they can be placed on or in the ear and are known as "ear level" or "in-the-ear" hearing aids (Northern & Downs, 1978). In addition, there are special kinds of hearing aids which are designed for use in classrooms.

(1) Body aids: Body worn instruments are usually rectangular in shape and are worn in a pocket, special harness over the chest, or clipped to the clothing. A wire cord runs from the aid to the receiver at the ear (Pollack, 1980). Body aids offer several advantages over other types of hearing aids. First of all, they usually provide greater gain and power output than ear level instruments (Northern & Downs, 1978). Since the microphone and receiver are separated by some distance, the probability of acoustic feedback (or squeal) is reduced. Acoustic feedback is a result of amplified sound that leaks out from around the earmold and "feeds back" into the microphone.

In addition, the body aid is more durable and the external controls are easier to adjust, although the latter often creates problems with children who inadvertently turn the volume down or shut it off (Northern & Downs, 1978). Currently, body aids are generally recommended mainly for children with severe and profound hearing losses (Pollack, 1980).

(2) Ear level hearing aids: Ear level instruments include behind-the-ear models, all-in-the-ear aids, or eyeglass models.

- behind-the-ear aids: These instruments rest behind the pinna (external ear) with a plastic "elbow" fitting over the anterior edge of the ear, connecting with a plastic tube that leads to the concha of the ear. Since the microphone and receiver are in the same case and in very close proximity to the earmold, acoustic feedback may be increased (Northern & Downs, 1978). Nevertheless, most hearing aids sold currently are behind-the-ear models since their power levels have increased over the years (Pollack, 1980). Other advantages include: their being less conspicuous than body aids, and hearing is restored to the natural level of the head, rather than on the chest (Downs, 1981; Northern & Downs, 1978).
- all-in-the-ear aids: These instruments fit directly into the ear canal, have no external wires or tubes and are very lightweight. They are generally recommended for adults with mild hearing losses since they are too small and fragile to be used with children (Northern & Downs, 1978). In addition, they are usually very difficult to fit successfully (Pollack, 1980).
- eyeglass aids: These instruments are essentially the same as the behind-the-ear type except that the plastic case which encloses the components is part of the eyeglass temple piece (Northern & Downs, 1978).

Beside the obvious advantage of this arrangement for those who wear glasses, the greater distance from the microphone to the ear, as compared to a behind-the-ear aid, permits the use of more acoustic gain without as much acoustic feedback (Pollack, 1980). The major disadvantage is that when repairs are necessary on either the eyeglass portion or the hearing aid, both units cannot be used while the instrument is being serviced (Northern & Downs, 1978).

(3) Special purpose hearing aids: In addition to personal hearing aids, a variety of special purpose hearing aids can be used by hearing-impaired children at home, in clinics, or in the classroom. They include hard-wire systems (group hearing aids and speech training aids), loop induction systems and radio systems (Ling & Ling, 1978). All three reproduce sound without significant decrease in intensity over distance and speech-noise ratios can be obtained that are superior to those usually provided by individual hearing aids.

The following is a list compiled by Haskins (1972) which generally outlines the attributes a hearing aid should have:

(1) sufficient power. If possible it should perform effectively when the volume is set at less than maximum;

(2) useful frequency response, one which enables the user to hear as clearly as possible. The person's ability to discriminate the fine differences among speech sounds should be maintained and, if possible, improved with amplification;

(3) wearability and comfort in terms of an earmold which seals in the desired amount of amplified sound. Amplification should not be sacrificed to avoid feedback. All too often people are advised to lower the volume to avoid the whistle. This is poor advice and may reduce

the person's range of hearing by 3 to 8 feet;

(4) a governing control to limit the maximum output in the event of an excessively loud signal;

(5) reasonable durability;

(6) volume controls that are easily manipulated; and

(7) battery life which is feasible for the amount of use. If a person uses his hearing aid 16 hours daily, it is not practical to have to replace the battery every other day.

Northern & Downs (1978) cautioned that hearing aid recommendations must involve a realistic understanding of the hearing aid's potential. Unfortunately, no hearing aid will enable a hearing-impaired child to hear normally in <u>all</u> situations. The primary reason for recommending the use of amplification is to help the child communicate better with a hearing aid than without one.

The Educational Status of Hearing-Impaired Children

The congenitally hearing-impaired child is born with a deficient auditory structure which seriously reduces the capacity of the environment to act upon him (Sanders, 1976). This limits the learning of linguistic rules which are critical for the process of translating the acoustic signals of speech. Therefore, the hearing-impaired child frequently has great difficulty with language development which underlies his deficiencies in other areas such as speech, reading comprehension and writing skills. These skills are all dependent upon the individual's linguistic abilities and grow out of rich and vast language experiences which hearing-impaired children usually lack (Denton, 1972).

Hence, studies of school-age hearing-impaired children uniformly suggest that the underlying area in which children with hearing losses are weakest is in language. For example, on academic achievement tests, hearing-impaired children scored lowest on word meaning and paragraph meaning subtests (Moores, 1970). Furth (1966) indicated that only 12% of hearing-impaired adults ultimately achieve true linguistic competence and only 4% are proficient speakers or lip readers. Vernon (1972, p. 533) compiled a table listing the four major studies which investigated the educational achievements of hearing-impaired children, presented in Table 3. As can be seen from the table, reading and written language achievement were very low.

Insert Table 3 about here

In addition, a recent demographic survey conducted by Gallaudet College (Reis, 1973, cited in Northern & Downs, 1974) reported the result of Stanford Achievement Test reading subtests, administered to 19,000 hearing-impaired persons in the United States. The results indicated that the highest average score in the section representing language comprehension was obtained by the 19 year-olds and was equivalent to the average fourth grade level.

Educational Programs for the Hearing Impaired

Currently, in North America, three alternative educational programs exist for hearing-impaired children: (a) programs employing manual communication only; (b) total communication programs involving all forms of communication; and (c) oral programs which include partial integration into regular schools and complete integration into regular classrooms. A shift toward the use of manual communication (sign language and finger spelling) as a supplement to oral teaching has been witnessed in recent years (Ling, 1975b). Hence, the

Table 3

Studies of the Educational Achievement of Hearing-Impaired Children

Investigator	Samples	Results
Boatner (1965) & McClure (1966)	93% of deaf students in U.S., age 16 or older	1) 30% functionally illiterate 2) 60% grade level 5.3 or below 3) Only 5% achieve at 10th grade or better and most of these are deaf or hard of hearing
Wrightstone, Aronow, & Moskowitz (1962)	73 school programs for deaf representing 54% of deaf school children, ages 10 to 16	1) Average gain in reading from age 10 to age 16 less than one year (0.8 months) 2) Average reading achievement of 16-year-olds was grade level 3.4 3) 80% of 16-year-olds were below grade level 4.9 in reading
Schein & Bushnaq (1962)	Gallaudet College population and estimates of other deaf college students	1) 1.7% of deaf school age population attend compared to 9.7% of hearing school age population

(continued)

Table 3 (Continued)

Investigator	Samples	Results
Babbidge Report (1965, p. 23)	269 schools and classes, 23,330 deaf children, 76% of deaf school age children (90% of residential school pupils and 57% of private residential pupils. Day classes and schools not represented).	1) Median average on Stanford of school leavers is 5.9 2) 13% of students "left" at age 16 or before 3) About 3% were denied admission 4) Waiting list for residential schools was 3.6% of enrollment, for private school, 48.5%

Note. From Vernon, 1972, p. 533.

emergence of total communication schools for the hearing impaired is becoming more evident (Jordan, Gustason & Rosen, 1976). Oral schools for the hearing impaired nevertheless remain quite popular, and often have as their logical extension partial or total integration into regular schools with hearing children.

The following section describes the major objectives, philosophies, tenets and guidelines of both oral and total communication programs of education for hearing-impaired children. The oral approach is presented first since basic elements of the oral system are also incorporated into total communication educational settings.

The oral-aural method. The oral-aural (verbal-auditory) method represents an attempt to assist the hearing-impaired child in becoming a viable member of society by aiding him to communicate in the manner most commonly used, that is, verbal language and speech (Berger, 1972). The goal is to permit the child to achieve as much integration into normal life as possible. Ling (1973) claimed that teaching speech and language through exercises based on rules is usually dull and largely unsuccessful. In essence there is no better way for a hearing-impaired child to acquire natural language and speech than through its meaningful use under conditions which allow him to hear and use as much of it as possible, as often as possible.

The oral method involves the teaching of speech as an expressive skill and the teaching of lipreading or speechreading as a receptive skill (Brill, 1974). Thus speech and speechreading are regarded as the best means of communication for the transmission of thoughts and ideas for hearing-impaired individuals.

Residual hearing is a very important aspect of the oral approach (Castle, 1970). Recently, there has been an increasing emphasis on amplification for hearing-impaired children as a result of improvements in the gain and frequency response of hearing aids. In addition, educators and audiologists are becoming increasingly aware of the important role the auditory monitoring system can play in the hearing-impaired child fitted with proper amplification. The use of hearing aids offers the young hearing-impaired child an opportunity to learn to hear basic intonation patterns, to make maximum use of intensity and frequency cues within his range of hearing, to monitor his vocal output and to respond to environmental sounds within his range of residual hearing (Castle, 1970).

The concept of total deafness and the proportion of children described as being "deaf" has changed quantitatively as more powerful acoustic instruments are being used to test hearing (Hirsh, 1966). The child currently considered totally deaf is not able to respond to sound at 100 dB hearing level at any frequency, or sometimes as much as 120 dB hearing level on audiometers constructed especially for measuring these profound hearing losses. Hence, most hearing-impaired children possess a significant capacity for residual hearing (Ross & Calvert, 1977).

In general, the aural-oral approach consists of early discovery of the hearing loss, thorough audiological examinations, the early prescription and continual monitoring of hearing aids, parent guidance, normal nursery school environments, use of high fidelity speech teaching aids, and oral stimulation at all times using natural language and a normal rate of utterance (Reeves, 1977).

The following are the essential components of an oral program delineated by the American Organization for Education of the Hearing Impaired (1975, pp. 433-435):

(1) faculty of classes for hearing impaired having philosophy and basic skills to insure that a majority of profoundly deaf children can be educated in an auditory oral environment;

(2) appropriate amplification in each room;

(3) supervisors of local programs for hearing impaired having philosophy and basic skills to insure that a majority of profoundly deaf children should be educated in an oral environment;

(4) administrators of local programs for hearing impaired having a philosophy that a majority of profoundly deaf children should be educated in an oral environment;

(5) supportive services available for teachers of normally hearing who have hearing-impaired students integrated into regular classrooms;

(6) parents of hearing-impaired children having a philosophy that a majority of profoundly deaf children should be educated in an oral environment;

(7) cumulative folders maintained on each child and available to faculty;

(8) decisions as to class placement, recommendations for transfers, curriculum modification, and parental participation made by supervisory and teacher personnel;

(9) periodic conferences for parents;

(10) public education activities to identify hearing-impaired children prior to age two;

(11) pertinent student information collected by the supervising teacher and made available to classroom teachers;

(12) sufficient space for physical activities and equipment for children under age 6;

(13) periodic evaluation of speech and language curriculum outlines to measure attainment of short and long-range objectives;

(14) supportive services by teachers of the deaf available through high school whether integration is full or partial;

(15) an audiologist;

(16) repair facilities for one-day service on amplification and instructional media equipment;

(17) curriculum procedures designed to stress self-responsibility and decision making on the part of hearing-impaired students;

(18) yearly evaluation of students' progress toward attainment of long-range objectives developed by faculty;

(19) yearly evaluation of students' progress toward attainment of short-range objectives developed by faculty;

(20) typewriter, duplicator, and Thermo-fax equipment available for teachers;

(21) yearly staffing of all students to determine if changes in individual scheduling or placement are warranted;

(22) yearly evaluation of students' proficiency in oral communication through use of tests, tapes, and listeners;

(23) on-going curriculum evaluation conducted by administrators, supervisors, and teachers in a coordinated effort;

(24) current audiological report as part of formal applications procedure;

(25) speech curriculum providing for systematic attainment of specific skills and competencies, preschool through junior high school;

(26) language arts curriculum characterized by continuity of methodology from preschool through junior high school;

(27) yearly evaluation of students' use of their residual hearing;

(28) parent interview as part of formal application procedure;

(29) yearly report to parents on the academic level attained by child;

(30) personnel in state department of special education having a belief that a majority of profoundly deaf children should be educated in an oral environment;

(31) supervisors and administrators who evaluate total school program yearly relative to attainment of short-and long-range objectives;

(32) selection of new personnel (administrators, supervisors, and teachers) by experienced educators of the hearing impaired;

(33) short-and long-range objectives (academic, communicative, and social) expressed in observable and measurable form;

(34) written evaluation of child's status sent to parents at least three times yearly;

(35) provision for junior and senior high students not recommended for integration to be served by teachers of the deaf;

(36) library in building with extensive listings of high-interest, low-reading-level books;

(37) faculty budget for special supplies, field trips, and materials;

(38) class size limited to six in preschool;

(39) provision for operation of classes within a district or in cooperation with other districts to provide homogeneous grouping not to exceed two grade levels per class;

(40) acoustically treated classrooms;

(41) public education program to orient the community as to the academic and vocational capabilities of the hearing impaired;

(42) yearly evaluation of total school program by faculty and presentation of recommendations to supervisors and administrators;

(43) class size limited to seven in primary grades;

(44) vocational rehabilitation specialist for programs with students over age 14;

(45) content of workshops and seminars determined jointly by supervisors and teachers;

(46) diagnostic services at a medical center or speech and hearing unit;

(47) psychologist or psychiatrist with experience in serving the hearing impaired;

(48) school district administrators having a philosophy that a majority of profoundly deaf children should be educated in an oral environment;

(49) proximity to facilities used by normally hearing children;

(50) physical education facilities (for certain climates this would include both indoor and outdoor);

(51) reference materials available in library or classrooms for student use throughout day; and

(52) parent counselors for work with families having hearing-impaired infants, ages 0 to 3.

Ling, Ling, and Pflaster (1977, p. 209) indicated that oral school programs must meet the following eight conditions in order for the majority of hearing-impaired children to acquire proficient spoken language skills:

(1) early detection of hearing loss;

(2) early admission of the hearing-impaired child to a program that offers continuity of assessment and treatment;

(3) full-time use of appropriate amplification to exploit residual audition from early infancy;

(4) a highly competent teacher-therapist to work frequently, intensively, and individually with the child and his parents;

(5) parents who collaborate in the child's treatment program;

(6) extensive exposure of the child to the spoken language patterns that should be common to both home and school;

(7) abundant interaction between the child and his hearing peers; and

(8) medical, psychological, audiological and technical (for hearing aid maintenance) support services which meet the needs of the teacher-therapist, the parents, and the child.

Calvert (1976) discussed the major factors important in the development and refining of the auditory approach which included:

(1) the development of miniaturized electronic hearing aids;

(2) the recognition that the population of so-called "deaf' children is not uniform. Annual surveys of the Office of Demographic Studies at Gallaudet College demonstrated that about 1/2 of the children enrolled in classes for the hearing impaired have pure-tone threshold audiograms reflecting hearing levels of 84 dB or better. Over 1/5 have hearing levels of 64 dB or better. Even when threshold audiograms are similar, important differences in auditory abilities are sometimes revealed by auditory discrimination tests or by diagnostic teaching;

(3) the contribution of acoustic phonetics to the study of speech perception. For instance, Calvert (1976) resported that the presence of important speech information in the lower frequencies where hearing-impaired children often respond to sound, means that such information may be made available to the child through appropriate amplification. Secondly, the contribution of transitional characteristics between speech sounds to the perception of the surrounding sounds helps explain why the adjoining high pitched consonant is sometimes "heard." This is

a result of the direction in which the lower pitched vowel formants are bent, even though the consonant itself may not be audible. Third, the concept of linguistic and phonetic redundance. That is, the speech signal contains more than enough information for its perception and explains how speech can be understood when parts of the signal are missing; and

(4) early and comprehensive intervention involving early educational programs, parent-guidance training programs, and early amplification. Calvert warned that such intervention is likely to be successful only with careful monitoring of the child's hearing aid usage.

Mainstreaming. Clark (1975, p. 1) defined mainstreaming as "An educational programming option for handicapped youth which provides support to the handicapped student(s) and his teacher(s) while he pursues all or a majority of his education within a regular school program with non-handicapped students." In contrast, partial integration is "an instructional option for deaf students where integration under carefully defined conditions can be provided for part of the school day while special classes for deaf students continue for the rest of the day" (Craig, Salem, & Craig, 1976, p. 63).

Mainstreaming and the partial integration of hearing-impaired children with hearing students provide either an alternative or a supplement to oral programs where children with hearing impairments are entirely segregated from their hearing peers (Craig et al., 1976). The ultimate goal of the oral system is integration as early as possible into a school for normal hearing children (Erber, 1975). Leckie (1973) further specified that the logical extension of oral education requires an end to the initial segregation of hearing-impaired children who do not really need the special services of a school for the hearing impaired. She also espoused integration into mainstream programs as quickly and extensively as possible for those who had been initially segregated. Supporters of mainstreaming or partial integration of hearing-impaired children believe that the earlier a hearing-impaired child begins to actively participate in hearing society, the more likely it is for his speech and language skills to reach normal hearing standards through his association with the hearing world (Erber, 1975).

To facilitate the transition to a normal school, the hearing-impaired child frequently attends regular classes only part-time before attempting complete integration (Erber, 1975) and spends the rest of his time in special units designed for partial integration. Many schools, especially in the United States, employ a staff of audiologists and teachers of the hearing impaired who assist the hearing-impaired child in speech, language, reading, or other academic subjects in which he may be having difficulty. These professionals also provide counsel and instruction to the parents and the regular classroom teacher.

Dale (1974) explained that the manner in which hearing-impaired children are mainstreamed into ordinary schools depends on various factors such as the hearing loss of the child, intelligence, home background, personality, the size of the class in the regular school, the ability and aptitude of the regular school teacher, and the amount and quality of special services available to the child. He specified that hearing-impaired children can be integrated into regular schools in several ways:

(1) full-time attendance in a regular class with no additional help beside that of amplification and occasional evaluations by a teacher of the hearing impaired;

(2) full-time attendance in a regular class, but with additional assistance from a teacher of the hearing impaired, a speech therapist or a remedial teacher once or twice a week;

(3) daily or twice daily assistance from a teacher of the hearing impaired in a special room or clinic provided for this purpose;

(4) attendance in a unit or special class during most of the day with integration into a regular class for subjects such as physical education, arts and crafts, general science, and for technical subjects such as woodwork, typing, and technical drawing; and

(5) attendance in a unit class for approximately half the day and integration in the regular class for the remainder accompanied most of the time by a teacher of the hearing impaired. During the time in the regular class, the special teacher and the regular teacher share the classroom for reading activities, mathematics, or arts and crafts.

<u>The total communication approach</u>. The second major educational option currently available to hearing impaired children, total communication, was officially defined by the Conference of Executives of American Schools for the Deaf (1976, p. 358) as, "A philosophy requiring the incorporation of appropriate aural, manual, and oral modes of communication in order to ensure effective communication with and among hearing-impaired persons." The basic premise of the total communication approach is that all major methods or systems of communication should be used (Northern & Downs, 1978). Thus, all students are exposed to natural gestures, sign language (the use of varying formalized manual configurations to convey meaning), fingerspelling (the alphabet spelled out manually), and reading and writing. Together, sign language and fingerspelling are known as manual communication. In addition, residual hearing is emphasized for the development of speech skills and

lipreading ability through the use of individual and high fidelity group amplification systems. The approach also maintains that the hearing-impaired child should be in a class with other hearing-impaired children, be it in a regular or a special school (Freeman, 1976).

Garretson (1976) compiled a list of assumptions underlying total communication programs, which included:

(1) the belief that hearing-impaired individuals have a moral right to maximal input in order to attain optimal comprehension in the communication situation;

(2) acceptance of the underlying philosophy that all visual, manual, oral and auditory roles in the communicative process are complementary and the belief that increased learning potential is achieved with the added dimensions of a multi-sensory approach. Total communication also provides for individualized communication strategies by allowing for different levels of ability in the various communicative modes;

(3) early identification and full acceptance of the child as a hearing-impaired individual in order to provide for the child's communication needs and language development; and

(4) awareness of the implifications for total communication beyond the classroom situation such as the provision of opportunities for a wide choice of social communication with both hearing-impaired and hearing persons in a variety of settings.

Supporters of the total communication point of view believe that signs reinforce lipreading and audition when signs and speech are used simultaneously and if the child is using amplification suitable for his needs (Kent, 1971). For the child who cannot benefit from amplification, signs can reinforce lipreading, and speech must be developed purely on a kinesthetic basis. In addition, when speech and signs are practiced simultaneously, syntactic structures are more apt to be incorporated. When a hearing-impaired person uses speech with signs, he is forced to organize his signing syntactically. It is also claimed that fingerspelling reinforces reading and writing and requires a similar knowledge of language. Finally, amplification reinforces aural-oral skills when hearing aids are fitted correctly, monitored frequently and worn consistently. Brasel and Quigley (1975) believe that a language base from manual communication should ease the task of the hearing-impaired child in learning to recognize words he already knows when he sees them spoken.

Current sign systems. Manual communication includes two basic systems, sign language and fingerspelling (Brill, 1974). In actual practice, both sign language and fingerspelling are used in the same communication.

Some total communication programs have opted for a specific manual system, but practically all the recently developed manual languages have borrowed their basic vocabulary from American Sign Language (ASL) or Ameslan (Garretson, 1976). Currently, it is generally recognized that ASL represents a formal language structure distinct from English, with its own semantic, syntactic, morphological, transformational and phonologic rules based on "cheremes" rather than phonemes (Garretson, 1976). "Cheremes" are defined with respect to the four parameters of signs, configuration, movement, orientation and place of contact. When combined simultaneously, they form a sign vocabulary according to formational rules that are specific to each sign language. Sign symbols, just as word symbols, express the thoughts and ideas of the signer. Minimal fingerspelling is used in ASL. ASL is the form of manual communication commonly used by the large number of hearing-impaired persons who have inadequate English syntactic skills (Brasel & Quigley, 1975).

Recently, several manual sign systems have been developed to overcome apparent inadequacies of ASL (Northern & Downs, 1978). Although ASL is effective for communication, its syntax is not necessarily related to the grammatical structure of English. The current sign systems assume that the more syntactically correct the symbols, the more the hearing-impaired child's development of language will be aided. The following are some examples of recent sign systems that have been originated:

(1) Signed English (Siglish), which is perceived as an ASL based system but more closely adopts the syntax and word order of English (Garretson, 1976). Siglish also involves the increased use of fingerspelling rather than the invention of new signs for inflection and affixes. Siglish is the form of sign language most commonly used simultaneously with English speech; and

(2) Manual English, retaining many of the root signs of ASL, has devised some new signs or has modified existing signs in its various systems: Signed English, Seeing Essential English, Signing Exact English and Linguistics of Visual English (Garretson, 1976). Manual English attempts to reproduce English morphology in the visual mode.

Generally, Manual English and the other new sign systems have created signs for some of the more functional morphemes of the English language which previously had no sign equivalent (Brasel & Quigley, 1975). The objective of these systems is to provide another code for the visual representation of English in signs. When used in combination with aural-oral modalities, it is thought that multiple reinforcement of the use of the English language is effected (Garretson, 1976).

The "combined" method of manual communication includes the use of speech, lipreading, hearing aids and fingerspelling (Fant, cited in

Northern & Downs, 1978). The "simultaneous" method differs only in that it also includes sign language as one of its modes of communication.

The Educational Controversy

Advocates of both manual communication and oral education have been locked in bitter and emotional debate for over 100 years regarding the relative values of the aural-oral or total communication options. The literature overflows with heated arguments, debates and biased investigations concerning the relative merits of either approach, a small sample of which include Alterman, 1970; Bonvillian and Charrow, 1972; Furth, 1973; Moores, 1970; Nix, 1975; and Vernon and Koh, 1969.

When educational methods are compared, the confounding variables that arise seem insurmountable. For example, Downs (cited in Alpiner, 1976, p. 34) pointed out some of the difficulties which included: "accurate matching in a small population such as the hard-of-hearing is impossible; obtaining equal teacher motivational attributes is impossible; and environmental and temporal situations cannot be controlled."

In recent years, this controversy has shifted from the oral versus manual to the auditory-oral versus total communication since the total communication philosophy has spread rapidly in the United States and in many cases has superceded strictly manual approaches (Northern & Downs, 1978).

Those who argue for the simultaneous use of signs and speech maintain that those children who cannot benefit from oral education should not be deprived of sign language at an early age and that hearing-impaired individuals should be given the opportunity to communicate with the entire population of hearing-impaired persons (Silverman, 1971). Proponents of the total communication approach contend that the early use of all modes of communication encourages the development of language, thereby enhancing early psycho-social and cognitive development (Mencher & Gerber, 1981). A true total communication approach should not restrict or limit the development of speech. Since the success of language and speech development cannot be predicted, the hearing-impaired child should be given every opportunity to develop language via the total communication approach without inhibiting the development of oral language.

Those who advocate a total communication philosophy generally contend that too often the results of exclusively oral teaching are unsatisfactory and that the hearing-impaired child cannot make himself understood to an untrained listener (Silverman, 1971). Furthermore, it is argued that many children do not have the aptitude to benefit from oral instruction and the time spent thereby could more profitably have been used in concentrating on the child's cognitive development through the use of sign language. It is also asserted that oral programs endorse restrictive modes of communication which reduces the quality of inter-child interaction (Denton, 1972). Consequently, the child's language development would also be restricted since language skills evolve and expand through usage. Generally, the shortcomings of the oral approach are claimed to be inferior educational attainments, poor social adjustment and emotional instability (Reeves, 1977).

On the other hand, the fundamental assumption of the oral approach is that only through auditory-oral training can a hearing-impaired person adjust to a world in which speech is the chief medium of communication and function as an independent person (Silverman, 1971). The ability to speak and understand speech also enables hearing-impaired persons to enter the labor force and select from among a wide range of employment opportunities as well as to achieve higher levels of socioeconomic standing (Ling, Ling & Pflaster, 1977).

With respect to the simultaneous presentation of oral and sign language used in total communication, proponents of oral education contend that sign language may restrict or confuse the development of oral language (Ling et al., 1977). Since sign language is a less complex language learning task from expressive and receptive points of view (Brasel & Quigley, 1975), it may become the preferred mode of communication, thereby superceding the use of oral language. Furthermore, critics argue that overstimulation of the hearing-impaired child may actually be detrimental to the development of communication skills (Northern & Downs, 1978). Ling et al. (1977, p. 217) claimed that some hearing-impaired children learning to simultaneously use speech and signs "does not imply that all can do so or that these particular children could not have achieved even better spoken language if signs had not been used."

Ling (1981a) pointed out that no results have as yet been published to support the claim that the early introduction of sign language, except for hearing-impaired children of deaf parents (Stuckless & Birch, 1966), has any advantage over early oral education. Ling (1981a) maintained that unless it can be demonstrated that speech, academic achievements, and social adjustment are over a long-term period fostered to a greater extent by the total communication approach than by oral training, "there can be no justification for the trend to discard an oral approach in both early and later education" (p. 321). Since the success of speech and language development cannot be predicted, it is essential to provide the hearing-impaired child with every opportunity to develop oral language before inhibiting it with a manual system (Mencher & Gerber, 1981).

Summarizing the educational controversy issue, Mencher and Gerber (1981, p. 4) stated that "At present, there are conflicting research findings with respect to both of these positions and the associated issues. We are in need of further research to be able . . . to develop tools for predicting which children will learn and function best under which management system."

Factors Which Influence the Educational Potential of Hearing-Impaired Children

The choice of communication modes for the hearing-impaired child should not be based on the particular bias of the school administrator, audiologist, or medical doctor, as is the usual current practice. This important decision should have as its basis a consideration of the many factors that affect the child from medical, social, emotional, psychological and economic points of view, and the main consideration must be the child's right to achieve his maximal potential communication abilities.

Haskins (1972) pointed out that once the presence of a hearing loss has been verified, the audiological test results alone do not supply all the information on how to proceed regarding the child's educational potential. Equally important is a consideration of the child's functioning in a variety of ways such as his social adjustment, dependency on parents, maturity, and spontaneous development of communication modes (Haskins, 1972). Pollack (1974, p. 7) also maintained that "An audiogram does not tell us what each child will do with his residual hearing. It is well known to teachers that a child with a mild loss is not always less handicapped than one with a severe loss--intelligence, home training, a congenital or acquired hearing loss, etiology and other factors are vitally important." Pollack (1981) stated that intactness of the central nervous system and the quality of parental involvement are far more important than the audiogram in predicting a successful outcome.

Regarding the factors that influence educational achievement, Ling et al. (1977, p. 205) suggested that "The degree of a hearing impairment, its etiology, and the child's age at onset of deafness can all affect a child's potential to communicate and learn." Griffiths (1973) also warned that an additional learning disability, non-supportive parents and parents who do not keep the hearing aids in good working order, or other environmental problems will impede the child's progress such that he may never develop effective auditory verbal skills. Intelligence, social maturity, and family background of hearing impaired children vary considerably (Gildston, 1973). Any one or a combination of the above factors may be even more significant than the child's hearing loss in determining his ability to learn. For example, a dull child with a mild hearing loss may not succeed academically as well as a highly intelligent child with a profound loss.

Other factors that Tell, Feinmesser and Levi (1981) found to be important when planning their habilitation program (i.e., the development of skills, as opposed to rehabilitation), for hearing-impaired children were the age of the child, the degree of hearing impairment and psycho-motor development, as well as the family's intellectual level and socioeconomic status.

The presence of additional handicaps which affect the learning potential of hearing-impaired children include severe visual problems (Shields, 1972), brain injury (Baru & Karaseva, 1972), retardation (Lloyd, Rolland, & McManis, 1967), emotional disturbance (Green, 1972), or learning disabilities (Auxter, 1971). The prevalence of hearing-impaired children with multiple problems is considered to be increasing and is greater than that found in the normally hearing population (Rawlings, cited in Ling, 1975b).

The following is a discussion of specific factors which influence the linguistic and spoken language achievements of hearing-impaired children.

Residual Hearing

It has been demonstrated that considerable remnants of hearing (residual hearing) are present in many children with congenital hearing losses; in fact, doubt has even been cast on the existence of total deafness, except in very rare cases (Whetnall & Fry, 1971). It has also been shown that the child can use his residual hearing in order to learn to listen, to speak, and to understand speech. Unless the hearing-impaired child's residual hearing is utilized, "communication processes cannot develop in the same manner as occurs in a normal hearing child" (Sanders, 1976, p. 43). The more severe the hearing loss, the more remote the possibility that the child will acquire speech completely naturally (Ling, 1975a).

Ross (1976) maintained that in general, the single best predictor of a hearing-impaired child's academic performance and verbal communication abilities is the degree of hearing loss. He based this conclusion on the following studies:

(1) Ross, Kessler, Phillips, and Lerman (1972) reported that when the auditory scores of hearing-impaired children on the Word Intelligibility by Picture Identification Test (a speech discrimination test) were correlated with the average hearing loss of the children, the magnitude of the negative correlation (-.58) indicated that word discrimination scores became poorer as the degree of hearing impairment increased;

(2) Luterman (cited in Ross, 1976) conducted a retrospective analysis in 1974 and concluded that hearing level was the single most important factor in determining the educational placement of hearing-impaired children;

(3) in another study by Quigley and Thomure in 1968 (cited in Ross, 1976), it was demonstrated that as the degree of hearing loss increased, so did the degree of academic retardation; and

(4) as part of a regular yearly evaluation, Ross (1976) noticed that the children with the best hearing had the highest scores on all the measured dimensions such as the Peabody Picture Vocabulary Test, Preschool Language Test, and Stanford Achievement Test.

Parental Support

When a child is diagnosed as hearing impaired, the parents frequently react to this label by ceasing to talk to the child and fail to expose him to sufficient auditory experiences (Godd, 1970; Ross & Calvert, 1973). If the parents react to the child as if he were completely "deaf," his residual hearing will not be used effectively even though auditory training procedures may have been instituted in a clinic and a hearing aid fitted (Ross & Calvert, 1973). Thus, parental support in terms of enriched language and educational experiences are crucial if the child's language and speech abilities are to develop normally. Parents who collaborate in the child's treatment program and provide constant educational and verbal communication experiences are absolutely necessary in order for the child to develop proficient language and speech skills (Griffiths, 1973; Ling, 1973; Ling et al., 1977; Owrid, 1970; Pflaster, 1976; Pollack, 1974; Ross, 1972). The most effective auditory-oral programs emphasize the role of the hearing-impaired child's home and parents with the goal of utilizing every available resource to maximize the early language learning opportunities of the child (Horton, 1973). For example, Rister (1975) found that the parent's involvement in the educational process with respect to language training greatly influenced the success of students in oral programs.

The parents are the ideal persons to provide direct help to their hearing-impaired baby since the development of communication skills is essentially a full-time undertaking which depends on one-to-one relationships on a daily basis (Phillips, 1981). The clinician can achieve very little in weekly sessions. Therefore, the parents have to be aided in accepting a primary role in their child's habilitation.

Somewhat overlooked in the literature on parental support is the finding that the emotional or affective relationship between the parents and their hearing-impaired child is just as important as providing constant opportunities for enriching language experiences. For example, Greenstein, Greenstein, McConville and Stellini (1977) discovered that affective components of the mother-infant interaction seemed to be more salient for the hearing-impaired child's language acquisition than specific aspects of the mother's language behavior. The mother's ability to motivate the child without coercion was one of the best predictors of the child's language competence. "Emotional acceptance, ease in relating to the child, encouragement of independence, and sensitivity to the child's needs are all very highly correlated with the child's development of language skills" (Greenstein et al., 1977, p. 26). Greenstein et al. (1977) also found striking differences between the mothers of those children admitted to the auditory training program before and after 16 months of age in terms of both language behavior and close relationships with their children. The authors suggest that this finding lends support to the hypothesis that "Mothers who bring their children in earlier for diagnosis and remediation may be more sensitive, concerned, or have other personality characteristics which facilitiate language acquisition" (Greenstein et al., 1977, p. 29).

An additional study of mother-infant interaction with hearing-impaired children by Altman (cited in Greenstein et al., 1977), revealed that both active language enrichment and intense emotional support on the part of the parents of the hearing-impaired children were necessary for the development of superior language behavior in their children. Altman discovered that the mothers of children aged 4 to 7 who were rated as linguistically competent, were more actively involved in their children's language development, generated more verbal interaction, monitored their children's behavior with more feedback, placed more pressure on their children to perform, used more positive reinforcers, manifested more warmth and positive affect, used less negative reinforcers, and were more child-centered than mothers of linguistically less competent hearing-impaired children.

Verbal Communication

In order for a hearing-impaired child to develop verbal communication skills, he must constantly be exposed to a barrage of verbal stimulation both at school and in the home. The child must have effective speech training and adequate experience with normal speech patterns through verbal communication with normally hearing adults and peers (Ling, 1976). Therefore, the ethnic background of a hearing-impaired child is also an important consideration. When the parents of a hearing-impaired child are immigrants, often a second language is used in the home that is different from the language used at school. When this is the case, Ling (1976, p. 159) warned that "The hearing-impaired child is at a disadvantage if speech in the language that will be used in his schooling is not mastered as the first and dominant means of communication at home." In addition to a linguistic difference, there is also a cultural difference. Parents of foreign language backgrounds may be alienated if they are told they must stop using their native language at home and use only the language in which the hearing-impaired child is to be educated. Many are unable to follow these instructions because they cannot speak the new language; others may feel they would be rejected by their own linguistic community should they relinquish their native language (Ling & Ling, 1978).

Early Intervention

Educators of the hearing impaired encourage the early detection of hearing loss so that hearing aids may be fitted as early as possible. The reason for emphasizing early detection is that the hearing infant's capacity to stimulate himself by babbling helps him to become aware of the regularities of linguistic organization and aids him in monitoring his own output of speech sounds (Horton, 1973). The hearing-impaired child of the same age has a significant problem due to the lack of auditory feedback from his vocalizations. The hearing-impaired infant is additionally impeded by the deprivation of auditory input from his environment. Failure to compensate for these deficiencies through early amplification and auditory training seriously retards, if not prevents, the normal development of speech Horton, 1973). The early stages of development are most conducive to language learning such that attempts to establish learning at a later time may meet with diminished success (Lenneberg, 1972). In addition, evidence from sensory deprivation studies suggests functional, if not physiological atrophy, if a child is deprived of early sound stimulation (Ross, 1972), which provides a strong rationale for early habilitative measures.

Elliott and Armbruster (1967, p. 223) claimed that "While all hearing-impaired children, even under the best circumstances, are challenged by the task of developing communicative skills, the inadequate stimulation that results from delaying educational procedures . . . may produce an overwhelming language handicap." In fact, Elliott and Armbruster (1967) discovered that those hearing-impaired children who were found to have additional learning problems had been diagnosed as hearing impaired, fitted with hearing aids and had begun special educational programs at a later age than other equivalent peers who had been treated for their hearing impairments at an early age. The authors interpreted their data as suggesting that "Sensory deprivation in hearing-impaired children resulting from delayed educational procedures and delayed sound amplification may produce an additional learning handicap which is only partly reversible by later therapeutic procedures" (p. 209).

Ling (1981a) contended that many hearing-impaired children can acquire spoken language at a normal rate of development if efficient habilitative treatment is begun well before 1 year of age. However, children who begin treatment later in life and who have hearing levels averaging more than 90 dB usually lag behind normally hearing children in their development of speech communication skills.

Greenstein et al. (1977) demonstrated that the hearing-impaired children who were admitted to an auditory-oral program before the age of 16 months were consistently superior to the later admitted children in all aspects of language at age levels 24, 30, 36 and 40 months. These differences were particularly salient for expressive language. The data suggested that until the age of 16 months, earlier intervention seemed to have no effect on the hearing-impaired child. Greenstein et al. (1977, p. 16) proposed several hypotheses to explain the differences that occured after 16 months of age:

(1) parents who bring their children in earlier for diagnosis and remediation may be more sensitive, concerned, or have other personality characteristics which facilitate their children's language acquisition;

(2) there is a critical period for early intervention, possibly at or before 16 months, so that children aided before this age respond better than those aided later;

(3) auditory aids and auditory training as well as the passage of time may have an additive effect such that longer exposure to these conditions facilitiates language acquisition; or

(4) some combination of all the above.

Follow-up studies of hearing-impaired children who participated in early intervention programs commencing prior to the age of 3 have demonstrated near normal achievement in spoken language skills (Ling & Milne, 1980), social skills (Kennedy & Bruininks, 1974), academic skills (McClure, 1977) and in reading (Doehring, Bonnycastle & Ling, 1978). Calvert (1976) also discovered that children who were started on amplification and auditory training very early in life made superior use of their hearing.

The early intervention programs which have been successful in preparing hearing-impaired children to function well at an early age in regular classes seem to have several features in common which include (Phillips, 1981): active involvement of staff members in detection, diagnosis and management; the provision of counseling, guidance, and education for parents; parents who accept a primary role in the rehabilitation of their child; frequent audiological and otological monitoring to ensure maximum utilization of residual hearing; the development of communication by spoken language; a strong personal interest in the families on the part of the professionals involved; systematic ongoing evaluation of progress; and the involvement of professionals who are also engaged in research or teaching. Another important aspect of such early intervention programs is the provision of intensive auditory education based on the sequential and interrelated development of normal auditory, speech, and language skills (Pollack, 1981).

The role of the audiologist in early intervention programs is also essential in the identification of very young hearing-impaired children, in the selection and fitting of hearing aids and their follow-up, in the supervision of auditory functioning under various environmental conditions, in activating the provision of better listening conditions, and in conjunction with the early auditory learning process involving parent counseling (Harris, 1981).

The Effects of Prelingual and Postlingual Hearing Losses

Children who suddenly lose their hearing demonstrate very different degrees of language skills depending on whether the disease strikes before or after the onset of language (Lenneberg, 1969). If they lose their hearing before they are about 18 months old, such children encounter difficulties with language development that are very similar to those encountered by the congenitally hearing impaired. However, the children who lose their hearing after they have acquired language are much more successful in their language skills than their prelingually hearing-impaired counterparts. There appears to be a direct relation between the length of time during which a child has been exposed to language and the proficiency in verbal communication skills demonstrated at the time of retraining.

Socioeconomic Status

Lavatelli (1971) and Valletutti (1971) claimed that lower socioeconomic status has a negative influence on the language development of hearing persons. Socioeconomic status is composed of three critical variables: (a) family income; (b) occupational status; and (c) education. The last is of most direct concern since low socioeconomic status is generally related to lower educational levels which is likely to be the source of the language problem. Low income families with minimal education often converse through a polyglot mixture of partly grammatical language with a specialized non-standard dialect that can cause cognitive confusion in the hearing child growing up in the environment (Valletutti, 1971). Children from lower class backgrounds have been shown to rely on shorter sentences in speech than do their middle-class counterparts, they have a more limited vocabulary, their articulation is not as good, they perform relatively poorly in tasks requiring precise and somewhat abstract language, their ability to categorize, and their acquisition of more abstract and integrative language seems to be hampered by their living conditions (John, 1963).

Since low socioeconomic status has such a negative effect on the language abilities of hearing children, it is probable that this effect is even more marked when considering the language development of hearing-impaired children. In addition, the costs of all the specialized care and training that hearing-impaired children require such as audiological tests, hearing aid purchases, tutorial services, transportation to clinics and schools, specialized treatment programs and emotional and psychological counseling can frequently be very high. Consequently, some parents with very low incomes may not be able to provide all the services and benefits for their hearing-impaired child that are so important in developing skillful language and speech as well as emotionally stable and mature personalities.

The Educational Placement of Hearing-Impaired Children

The most important point to be stressed in the discussion concerning the educational placement of hearing-impaired children is that no one approach can be recommended for the education of all children with hearing impairments since these children do not form a homogeneous group (Rister, 1975). Because the audiogram is not the sole indicator for predicting potential educational success, by what means and at what age can the decision be made to recommend either an oral or total communication program? Sanders (1976, p. 46) asserted that,

> Not every child will be able to depend exclusively upon auditory learning for the acquisition of speech, language and conceptual function. I believe it is our responsibility to ensure that each child is provided with a system of communication which permits him to develop maximally as a human being. For some children, insisting on a purely auditory/oral system will seriously limit both their conceptual development and their ability to communicate with others. For other children only an auditory/oral approach can fully meet their needs. To politicize the issue, to make decisions for individualized children on the basis of a generalized political philosophy is to me abhorrent.

Educators of the hearing impaired maintain varying positions concerning the educational placement of hearing-impaired children. For example, Ling, Ling and Pflaster (1977) claimed that initial use of oral communication should be recommended for all hearing-impaired children. They argued that "Ongoing evaluation in the course of treatment can lead to the identification of those children who do not readily acquire spoken language skills and, thus, permit their transfer to a sign language program at an early stage, before permanent damage can result through deprivation" (p. 216).

Ling and Ling (1978) stated that the development of linguistic and oral skills in most hearing-impaired children requires the following conditions to be met:

(1) early detection of hearing impairment;

(2) early admission of hearing-impaired children to programs that offer continuity of assessment and treatment;

(3) full-time use of appropriate amplification;

(4) a highly competent teacher or clinician to work frequently, intensively, and individually with the child and his parents;

(5) parents who collaborate in the child's treatment program so that they are essential members of the habilitation team;

(6) extensive exposure of the child to fluent spoken language patterns that should be common to both home and school;

(7) abundant interaction between the child and his hearing peers;

(8) adequate support services such as regular examinations by an otologist, opthalmologist, audiologist and an electronics technician skilled in hearing aid maintenance. In addition, support services may occasionally be required of a psychiatrist, psychologist or social worker; and

(9) manual communication, used either as an alternative to speech or in parallel with it should not be used at this early stage.

Ling (1981a) claimed that on the basis of currently accepted measures, it is not possible to predict at the time of diagnosis those children who will fail and those who will succeed in the task of learning spoken language skills. The degree of the child's hearing impairment, intelligence, parental concern and ability, and additional handicaps as assessed on initial diagnosis cannot reliably indicate whether a child will be able to communicate verbally. Ling and Ling (1978) stated that "although initial diagnostic information is essential to the teacher/clinician who works with hearing-impaired children and their parents, it is not sufficient either for the selection of the most appropriate type of program or the choice of habilitative procedures to be used" (p. 323). Ling (1981a) maintained that the choice of most appropriate program or habilitative procedures has to be determined during the course of ongoing evaluative treatment in an oral program.

Unfortunately, currently available assessment procedures of early linguistic skills and related variables that influence linguistic performance such as parental support, are to a large extent inadequate or nonexistent. Furthermore, established criteria which decide the rate of progress considered too slow to justify the continuation of attempts to provide the hearing-impaired child with exclusively oral communication have not yet been objectively specified. Thus, the decision to transfer a child out of an oral program is frequently postponed from year to year. When the child is finally transferred, he may have lost several years of valuable academic training using an alternate communication system which he may have been able to master.

An additional concern with respect to Ling et al.'s (1977) position is that the parents of children who fail in early oral programs and are switched to programs using alternative approaches are often made to feel that their child has failed as a result of the transfer to a school that is now conceived of as being second rate (Springer, personal communication, 1978).

Tell, Feinmesser and Levi (1981) described an alternate auditory-oral habilitation program where the professional team reaches a decision concerning the most suitable educational program based on a consideration of several parameters. The decision is made individually for each child who has reached about 6 years of age and has been followed in the program from infancy. These factors include the ability to function through hearing, the quality of speech production, the child's language level as measured by formal language tests, results of standard intelligence tests, and behavioral and social maturity. The authors found that success of their habilitation program with the aim of integration into regular schools was secured when the following three conditions were fulfilled: (a) the parents were completely dedicated to the goal of integration, (b) the children had normal or above normal intelligence, and (c) there was an innate gift" (p. 365) for language acquisition or good progress in language development.

A differing point of view regarding educational placement was proposed by Northern and Downs (1974) whose main concern was that of normal language development for all hearing-impaired children. They stated that:

> For too long we have been misled into placing oral speech as the primary goal for all of these children . . . . If the child is not able to think in highly complex language symbols, does it matter whether he is able to vocalize any of them? And, most important, how can he verbalize adequately unless he has an adequate symbol system to utilize. The primary goal is always to tap the innate language skills by whatever means possible. Secondarily only will we aim for intelligible oral expression of that language--a skill that itself depends upon the acquisition of a high degree of language competence (p. 277).

Northern and Downs (1974) maintained that the educational method most suited for an individual child's language development should be the one that is selected. The child should not have to fail his trial period in an oral program in order to be placed in a more suitable educational setting. Rather, it should be apparent that a total communication approach is optimal for some children from the time the hearing loss is detected (Rister, 1975).

Various scales or "formulae" have been devised which attempt to guide the decision for educational placement by examining the qualifications of the individual hearing-impaired child. Downs (cited in Alpiner, 1976) proposed a formula which she called an "Expectation Index." Within this scheme, each child's actual progress in a specific program could be compared with the attainment levels expected of this particular child. The Expectation Index could predict how fast the child should learn and the language level that could be expected of this child at any given point in time. Downs (cited in Alpiner, 1976, p. 35) envisioned the following formula:

I = Intellectual and cognitive potential on nonverbal scales

D = Developmental potential

P = Psychological potential vis-a-vis family milieu

S = Socioeconomic potential or limitations

T = Time period expected to learn a given teaching unit

T_1 = Time period actually required

L = Language level expected for this age

L_1 = Language level present

$I + D + P + S + (T \times L) = E$ (Expectation Index)

$I + D + P + S + (T_1 \times L_1) = A$ (Actual Index)

These items could be manipulated to identify T, alone or L_1 alone, or some such combination. The Expectation Index could be used to evaluate whether a particular method was effective for adequate language development and speed of learning.

From a practical point of view, the individual factors on the Expectation Index have not been quantified or tested, nor was an attempt made to assign relative weights to the variables. It would currently not be possible to quantify certain of these factors such as "psychological potential vis-a-vis family milieu." Furthermore, the formula is far too simplistic and fails to account for many of the variables involved in the hearing-impaired child's language development such as residual hearing.

The formulation of a second scale by Downs (1974) was motivated by a concern with the large number of orally educated hearing-impaired children with very poor language and speech skills. Downs (1974) recommended that the total communication approach be used with those hearing-impaired children whose optimal language learning could not be accomplished primarily through auditory-oral input. However, Downs also maintained that a child with sufficient residual hearing and other "potential aptitudes" (p. 27) would best learn language and speech through auditory-oral methods. The basic problem was how to separate in infancy those hearing-impaired children who would best learn language through a total communication program from those whose optimal language learning would develop via an auditory-oral approach.

As a tentative solution to this problem, Downs (1974) and Northern and Downs (1974) formulated a predictive index consisting of a weighted scale which examined several aspects of the child and his environment. This scale was called the "Deafness Management Quotient" (DMQ) and is illustrated in Table 4.

Insert Table 4 about here

Five variables were included in the DMQ: Residual Hearing, Central Intactness, Intellectual Factors, Family Constellation and Socioeconomic Situation.

Table 4

Down's Deafness Management Quotient

Residual Hearing: 30 points possible

0 = no true hearing

10 = 250-500 < 100 dB

20 = 250-500-1000 < 100 dB

Add 10 points for conductive element to hearing loss

30 = 2000 < 100 dB

Central Intactness: 30 points possible

0 = diagnosis of brain damage

10 = known history of events conductive to birth defects

20 = perceptual dysfunction

30 = intact central processing

Intellectual Factors: 20 points possible

0 = MR < 85 IQ

10 = average ⟶ 85-100 IQ

20 = above average: > 100 IQ

Family Constellation: 10 points possible

0 = no support

10 = completely supportive and understanding

Socioeconomic Situation: 10 points possible

0 = substandard

10 = completely adequate

Total = 100 points

Auditory-oral program: 81-100 points

Total communication program: 0-80 points

Note. From Downs, 1974, p. 268.

Each variable was arbitrarily allotted a specific maximum value and the individual variables were divided into intervals.

The DMQ was designed as a predictive index so that the educational decision concerning the hearing-impaired child could be made as early as possible, thereby preventing the child's placement in an unsuitable educational setting. The rationale behind the DMQ was that a child with any one or a combination of the following problems: minimal or no residual hearing, evidence of brain damage, low intelligence, nonsupportive parents, or a low socioeconomic status, would not be able to cope with the trying demands of an oral education. Such a child would require support from a manual communication system which involves less complex language learning from both expressive and receptive points of view (Brasel & Quigley, 1975).

The purpose of the DMQ was not to advocate a particular educational approach for hearing-impaired children. Instead, the DMQ was designed to indicate that the auditory-oral method would be successful only for the hearing-impaired child who received high scores on the factors included in the scale.

The importance of a predictive scale such as the DMQ is that it can eventually be included as part of a battery of objective criteria used by educators of the hearing impaired, audiologists, speech pathologists, and medical doctors who are involved in the decision-making process regarding the educational placement of hearing-impaired children. Thus, the educational decision would be made for each hearing-impaired child on an individual basis.

The formulation of the DMQ attempted to provide specific predictive guidelines for allocating hearing-impaired children into the most suitable educational program. No previous study has been performed that has evaluated the construct validity of the DMQ as a predictive scale other than the following informal investigation conducted by Downs (personal communication, March, 1977). The DMQ was theoretically constructed and was then tested on 10 young adults in the University of Colorado Audiology Clinic who had attended oral or integrated programs for the hearing impaired. Eight of the 10 individuals attained language levels at the typical fourth or fifth grade level; the remaining two were linguistically very competent. It turned out that DMQ's for the eight were well below the 80 borderline, while the DMQ's for the two successful students were 81 or above. On the basis of such informal studies, Downs (1981) arrived at the following conclusion about the DMQ. "In general, this formula has held up fairly well when applied retrospectively to hearing-impaired populations" (p. 200).

The present investigation represents a preliminary attempt to formally evaluate the DMQ. In addition, a modified version based on the original DMQ was formulated by the author. The rationale for the modifications is outlined in Chapter 2. The modifications included the addition of four new variables, alteration of the weightings carried by each variable on the original scale, reduction of the borderline, and changes in the collection of data for the Residual Hearing variable. Downs's DMQ and its modified version were examined in order to investigate the ability of the variables on both quotients to predict the success of a hearing-impaired child in a given educational program.

The current study was designed as a retrospective one due to time limitations. Thus, performance scores of the subjects in reading comprehension and speech were retrospectively examined to indicate successful educational placement.

Major Research Questions

In addition to the general inquiry into the construct validity of the DMQ and its modified version, the following were the major questions posed by the present study:

(1) Which variables on the DMQ or on its modified counterpart were the best predictors of performance on the reading comprehension and phonetic speech tests?

(2) In a comparison of the five variables common to both the original DMQ and its modified version, which scale was superior in predicting the performance scores of the subjects?

(3) Of the five variables common to both the DMQ and its modified counterpart, only the Residual Hearing variable was obtained in a different manner on the modified scale. Was the predictive value of the modified Residual Hearing variable consequently improved?

(4) Which, if any, of the four additional variables included on the modified version of the DMQ contributed significant predictive value?

(5) What were the consequences of reducing the criterion on the modified version of the DMQ?

Limitations of the Study

The present study was limited with respect to representativeness of the subjects. Therefore, the conclusions based upon the findings of this investigation must be considered applicable only to the population represented by the sample of congenitally hearing-impaired pre-adolescent children. Generalizations to other populations should be made with caution. The study was also limited by the use of certain evaluative instruments such as the parent questionnaires, since self-report instruments are subject to a large amount of invalidating bias. An additional problem was that the present investigation was conducted on a retrospective basis. Ideally, investigation of a scale such as the DMQ should be longitudinal since it was designed as a predictive index. However, ethical considerations preclude such predictive studies.

Chapter II

METHOD

Subjects

Forty-two hearing-impaired children participated in the present study. Nineteen were enrolled at the Mackay Center for Deaf and Crippled Children which espouses the total communication method of education. The remaining 22 attended the Montreal Oral School for the Deaf (MOSD) which endorses the auditory-oral educational methodology. The Mackay Center and the MOSD are the only two English-speaking schools for the hearing impaired in Montreal. All students, without regard to sex or degree of hearing impairment, between the ages of 9-11 (as of September 1, 1976) participated in the study. One child was excluded from the study since he was unable to understand the directions to the tests. The 9 to 11 age group was selected because the children had been in school sufficiently long to have benefitted from their education in language and speech. As cited in Table 3, studies of hearing-impaired adults' educational attainments revealed a fourth grade average reading level, approximately the educational level of the present sample. Due to insufficient availability of English-speaking hearing-impaired subjects in the city of Montreal, the 9 to 11 age group was combined. This age group was considered to vary less than one which would include both high-school and elementary-school students.

All 23 subjects from the MOSD had attended from the earliest grades. All the subjects from the Mackay Center had been enrolled there for at least three years. Of the 19 students from the Mackay Center, six had been transferred from the MOSD and three had previously attended French schools for the hearing impaired. Four of the subjects from the Mackay Center were living in residential facilities provided by the school. Two of these four children travelled home every weekend and on all holidays. The other two children visited their homes only on holidays. The MOSD has no residential facilities. All parents of the hearing-impaired subjects had normal hearing except for the foster parents of one child from the Mackay Center.

All children at the MOSD were integrated with normal hearing children for a certain percentage of time each day, according to their abilities. Such a procedure is called "partial integration." Those children participating in the present study who were least capable of such academic integration joined the hearing children only for social activities such as. lunch or gymnastics. The remaining children who were partially integrated for academic sessions as well, were assigned to a regular classroom according to their age and academic achievements and followed the regular schedule for a specified proportion of the time. At regularly scheduled intervals on a daily basis, they met in a special resource room or "unit" with several other hearing-impaired children and received specialized help in academic areas in which they were deficient. Such an arrangement is also described by Ross (1972) and is possible where there are a number of hearing-impaired children in one school or in adjoining districts. Partial integration of the children in the present investigation ranged from integration only for social activities up to 80% integration with hearing children in a regular classroom. Totally integrated children were not included in the study due to time limitations during the testing period. All the hearing-impaired children from the Mackay Center were educated in self-contained classes, i.e., no integration with normal hearing children in the classroom.

Description of the Schools

The Montreal Oral School for the Deaf (MOSD). All the basic principles of auditory-oral rehabilitation are stressed as being integral components of the program. These include the emphasis on amplification for all the children, the maintenance of individual and group high fidelity amplification and all other audiological equipment in optimal working condition, the only acceptable communication system being the auditory-oral one, an emphasis on development of speech skills, and the children's maximal use of their residual hearing monitored by frequent hearing aid evaluations and audiological assessments. The goal of the MOSD is integration as early as possible into a school for normal hearing children. The students at the MOSD all have at least normal levels of intelligence and their hearing losses range from mild to profound.

The Mackay Center for Deaf and Crippled Children. The educational system employed by the Mackay Center is that of total communication. The full spectrum of language modes are included in their teaching system, sign language, gestures, fingerspelling, speech and speechreading. Ongoing oral output is continuously maintained in conjunction with the manual communication. In addition, the hearing-impaired children are aided in developing their residual hearing for the development of speech skills and the enhancement of speechreading ability through the use of individual and group high fidelity amplification systems. The hearing-impaired population at the Mackay Center is of normal intelligence with the exception of several multiply handicapped children. The hearing losses of their students also range from mild to profound.

Materials and Procedure

Although the results of the informal investigation concerning the Deafness Management Quotient conducted by Downs (personal communication, March,

1977) seemed to endorse the DMQ as an accurate predictive instrument for the educational placement of hearing-impaired children, it was nevertheless apparent that certain alterations of the DMQ were necessary. Thus, a modified version of the DMQ was developed by consulting various professionals in the field to obtain their recommendations regarding specific alterations of the original DMQ. These experts included Doris Leckie, former principal of the MOSD, Dr. Agnes Ling-Phillips, current principal of the MOSD and former faculty member in the School of Human Communication Disorders, McGill University, Dr. Daniel Ling, Professor of Otolaryngology and Education, School of Human Communication Disorders, McGill University, Dr. Susan Mattingly, former Director of the Division of Audiology, Montreal Children's Hospital and Dr. Steve Springer, Psychologist at the Mackay Center. Other consultants were the psychologist at the MOSD, the social worker at the Mackay Center and numerous teachers of the hearing impaired from both the Mackay Center and the MOSD. The final modified version of the DMQ that was constructed represents a consensus of their opinions and will henceforth be called the modified DMQ (M-DMQ). Downs's DMQ will be referred to as the D-DMQ. The modifications included the addition of four new variables, alteration of the weightings carried by each variable on the original DMQ, the arbitrary reduction of the borderline and changes in data collection for the Residual Hearing variable. The M-DMQ is presented in Table 5.

Insert Table 5 about here

Addition of New Variables

Several variables which were not included in Down's DMQ also seemed important for predicting the educational placement of hearing-impaired children; they included such factors as additional physical handicaps, the age of the child when hearing aids were initially fitted and regularly

Table 5

The Modified Deafness Management Quotient

Residual Hearing: 30 + 20 points possible

0 = no true hearing

10 = 250-500 HZ $<$ 100 dB hearing loss

20 = 250-500 - 1000 HZ $<$ 100 dB hearing loss

30 = 2000 HZ $<$ 100 dB hearing loss

- Subtract 5 points when:
  - a) the two ears differ by greater than 20 dB re the pure tone average; and
  - b) if the hearing thresholds at the speech frequencies are beyond the limits of the audiometer.
- Add 5 points for a severe hearing loss
- Add 10 points for a moderate-severe hearing loss
- Add 15 points for a moderate hearing loss
- Add 20 points for a mild hearing loss

Family Constellation: 30 points possible

0- 5 = inadequate

10-15 = fair

20-25 = good

30 = completely supportive educationally and emotionally

Central Intactness: 30 points possible

0 = visual motor impairment

15 = possible perceptual dysfunction

30 = intact central processing

Intellectual Factors: 20 points possible

0 = below average

10 = average

20 = above average

Linguistic Differences: 15 points possible

0 = parents speak no English

(continued)

Table 5 (Continued)

5 = parents speak some English, but generally not at home

10 = parents speak a language other than English to each other, but speak English with their hearing-impaired child

15 = no linguistic differences

Additional Physical Handicaps: 10 points possible

0 = severe

5 = moderate

10 = no additional physical handicaps

Amplification: 10 points possible

0 = after the age of 3

5 = by the age of 3

10 = by the age of 2

Mode of Communication: 10 points possible

0 = only gestures or signs

2.5 = single words and phrases in speech, but mainly gestures or signs

5 = some speech with many gestures or signs

7.5 = speech with minimal use of gestures or signs

10 = speech only

Socioeconomic Situation: 5 points possible

0 = substandard

5 = adequate

Total = 160 + 20 points

Auditory-oral program: 100-180 points

Total communication program: 0-99 points worn thereafter, the child's mode of communication with parents, and linguistic differences between the language of education and the language spoken at home. The latter variable was of particular importance in a multiethnic and multilingual society such as the one that exists in Montreal. Marion Downs (personal communication, April, 1977) endorsed the inclusion of the four factors delineated above into the modified version of the DMQ.

A fifth variable not included in Downs's DMQ was the presence of a prelingual or postlingual hearing loss. However, children with postlingual hearing losses are currently quite rare as a result of advances in modern medicine which have prevented the development of hearing impairments from high fevers accompanying childhood diseases such as measles or mumps (Brill, 1974). Since all the children in the present study had prelingual hearing impairments, it was decided to exclude this factor from the modified version of the DMQ.

Alteration of the Weightings

An additional problem with Downs's DMQ was the excessively strong weighting of the Residual Hearing variable. Rister (1975) and Lane (1976) reported that severity of hearing impairment is not in and of itself a useful predictor of success in an oral program. Ling (1975b, p. 124) wrote that "Providing the child has an intact central nervous system, yet only minimal residual hearing, there is still opportunity for oral success." Nevertheless, Downs arbitrarily allotted 30 points for the Residual Hearing variable, while subtraction of merely 20 points from the total score on her scale signified that the child in question should not be educated in an auditory-oral setting. Therefore, children with serious hearing impairments are almost immediately recommended for total communication programs by the

D-DMQ in spite of the fact that they may potentially have been successful in an auditory-oral setting if they did not have problems in the other areas assessed by the D-DMQ. In fact, Dr. S. Mattingly (former Director of the Audiology Clinic at the Montreal Children's Hospital) obtained retrospective D-DMQ ratings in the Audiology Clinic in July, 1977, for two children with profound hearing impairments who were both integrated and highly successful orally and linguistically in regular schools. The DMQ scores of both children were below 80 (the borderline on the D-DMQ), since they had lost so many points on the Residual Hearing measure. Yet these children had demonstrated that they were capable of successful integration into regular schools. In addition, the D-DMQ did not allot sufficient weighting to the Family Constellation variable. Doris Leckie, principal of the Montreal Oral School for the Deaf, strongly maintained that residual hearing and parental support are the two most important factors influencing the success of hearing-impaired children in an oral program (personal communication, March, 1977). This conclusion was further supported by an informal survey conducted by Leckie at an annual meeting for teachers of the hearing impaired. Hence, Leckie felt that in order for the DMQ to have any predictive validity, it must allot as much weighting to the Family Constellation measure as it does to the Residual Hearing variable.

Thus, the weighting associated with the Residual Hearing variable was proportionately decreased while the value of the Family Constellation variable was substantially increased on the M-DMQ. In addition, the value of the Socioeconomic Situation variable was slightly lowered on the M-DMQ since socialized medicine in the province of Quebec enables all families regardless of income to receive the necessary medical and audiological support services. Thus, socioeconomic status is of lesser concern in Quebec as a measure of financial support of the hearing-impaired child than it is for families residing in the United States. Table 6 illustrates a comparison of the weighted points alloted to each variable on the D-DMQ and M-DMQ.

Insert Table 6 about here

With the addition of the four new variables and the altered weights of the remaining variables, the total possible score on the M-DMQ was 180 points.

Reduction of the Borderline

The third alteration of the original DMQ was to lower the borderline at which the decision is made to opt for either an auditory-oral or total communication program. Downs (1974) set her borderline in the original DMQ at 80, permitting only 20 points to be deducted before recommending a total communication program. The result of using such a stringent borderline is that the majority of hearing-impaired children would be allocated to total communication programs since few could pass the borderline criterion incorporated in the original DMQ. Consequently, the new borderline in the M-DMQ was established at 100, permitting 80 points to be deducted prior to the recommendation of a total communication program. Thus, subjects whose total M-DMQ scores were 100 and over were assigned auditory-oral educational placements and total communication placements if their total scores were 99 or under. The basis for this decision was the intention to include all the MOSD subjects who were designated as "orally successful" by the MOSD principal who was familiar with each of the children. "Oral success" was defined as the ability to communicate effectively via a combination of

Table 6

Points Allotted for Each Variable on the D-DMQ

and the M-DMQ

Variable	Weightings	
	D-DMQ	M-DMQ
Residual Hearing	30 + 10	30 + 20
Parental Support	10	30
Central Intactness	30	30
Intellectual Factors	20	20
Socioeconomic Situation	10	5
Linguistic Differences	--	15
Additional Physical Handicaps	--	10
Amplification	--	10
Mode of Communication	--	10

audition, speech and lipreading. It was found that the lowest total M-DMQ score of the MOSD subjects who were identified as "orally successful" was 101. Therefore, 100 was established as the borderline criterion for the M-DMQ since it was desirable that no children who were effective oral communicators should be placed in total communication programs.

Adjustment of the Residual Hearing Variable

Certain adjustments were made to improve the Residual Hearing variable on the M-DMQ. These changes are outlined in detail under the section describing how data was collected for the Residual Hearing variable.

Following is a list of all the variables included in both the D-DMQ and the M-DMQ. Under each variable, the manner in which the pertinent information was obtained is described.

Residual Hearing

The Residual Hearing measurement was obtained from the subjects' most recent audiograms. The audiological evaluations of the students had all been conducted within the past year. The ear with superior hearing was used for calculations.

On the D-DMQ, the measurement was comprised of the pure tone average at 500, 1,000 and 2,000 HZ of the superior ear. Thirty points were arbitrarily granted if at 2,000 HZ or higher, the hearing loss was less than 100 dB; 20 points if at 250, 500 and 1,000 HZ, the hearing loss was less than 100 dB; and 10 points if at 250 and 500 HZ, the hearing loss was less than 100 dB. If the hearing loss was greater than 100 dB at 250 and 500 HZ, the subject was considered to have "no true hearing" and received no credit for Residual Hearing. Downs (1974) recommended that 10 points be added for a conductive element to the hearing loss; however, none of the children in the present study qualified for this point bonus.

The Residual Hearing variable on the M-DMQ was calculated in the same way with the following modifications, recommended by Dr. S. Mattingly (personal communication, June, 1978). Five points were deducted when the two ears differed by more than 20 dB re the pure tone average at 500, 1,000 and 2,000 HZ. An additional five points were deducted when the hearing thresholds at the pure tone average in one or both ears were beyond the limits of the audiometer, i.e., greater than 110 dB. In addition, it was apparent that the criterion whereby full points were allotted for the Residual Hearing variable on the D-DMQ was not sufficiently stringent. Thus, children who had a severe hearing loss could receive the same credit as those with a mild or moderate loss. Therefore, extra points were granted on the M-DMQ according to type of hearing loss as defined by Green (1972). Five points were awarded for a severe hearing loss (71 to 90 dB), 10 points for a moderate to severe loss (56 to 70 dB), 15 points for a moderate loss (41 to 55 dB), and 20 points for a mild loss (27 to 40 dB). No additional points were granted for those with profound hearing losses greater than 90 dB. Hence, the maximum possible score for Residual Hearing on the M-DMQ was 50 points. Table 7 illustrates the distribution of points for the Residual Hearing variable on the D-DMQ and M-DMQ.

Insert Table 7 about here

Central Intactness

The test selected as a measurement of Central Intactness was the Bender Gestalt Visual-Motor Test. Based on the conclusions of her study concerning this test, Koppitz (1963, p. 75) claimed that, "Children with neurological impairments have only rarely, above-average Bender scores.

Table 7

Distribution of Points for the Residual Hearing Variable

on the D-DMQ and M-DMQ

D-DMQ	M-DMQ
0 = no true hearing	0 = no true hearing
*10 = 250-500 HZ < 100 dB	10 = 250-500 HZ < 100 dB
*20 = 250-500-1000 HZ < 100 dB	20 = 250-500-1000 HZ < 100 dB
30 = 2000 HZ < 100 dB	30 = 2000 HZ < 100 dB
	- Subtract 5 points when
*Add 10 points for a conductive element to the hearing loss.	a) the two ears differ by greater than 20 dB re the pure tone average
	b) if the hearing thresholds at the speech frequencies are beyond the limits of the audiometer
	- Add 5 points for a severe hearing loss
	- Add 10 points for a moderate-severe hearing loss
	- Add 15 points for a moderate hearing loss
	- Add 20 points for a mild hearing loss
Maximum score = 40 points	Maximum score = 50 points

It appears safe therefore, to state that a poor Bender record may be thought of as indicating the possibility of brain injury . . . ."

The Central Intactness measurements for both quotients were computed in an identical manner. The Bender Gestalt Visual-Motor Tests were scored according to the criteria outlined by Koppitz (1963), called the "developmental Bender scoring system for children," in which the higher the test score, the greater the probability that the child is brain-damaged. Koppitz's normative data for the "developmental Bender scoring system for children" indicated that normal children age 9 to 10½ received mean scores ranging from 1.7 to 1.5. Thus, subjects in the present study who scored in the normal range of 0 to 2 on the Bender Gestalt Visual-Motor Test were awarded the highest credit of 30 points on both the D-DMQ and M-DMQ. A score of 3 to 5 on the Bender Gestalt Visual-Motor Test was designated as the uncertain range and merited 20 points on the D-DMQ and 15 points on the M-DMQ. Since it was impossible to obtain sufficient information concerning the prenatal and natal medical histories of all the subjects, the category "known history of events conducive to brain damage" was omitted from the D-DMQ. A score of 6 and higher on the Bender Gestalt Visual-Motor Test was interpreted as evidence for a "diagnosis of brain damage" on the D-DMQ and "visual motor impairment" on the M-DMQ and received no credit on either quotient. It turned out that those children with scores in this range had all been previously labeled as having a "learning disability" or "minimal brain damage" by their teachers or school psychologists. Table 8 presents the distribution of points for the Central Intactness variable on the D-DMQ and M-DMQ.

Insert Table 8 about here

Table 8

Allotment ~~of~~ Points for the Central Intactness Variable

on the D-DMQ and M-DMQ

D-DMQ	M-DMQ
0 = diagnosis of brain damage	0 = visual-motor impairment
10 = known history of events conducive to birth defects	15 = possible perceptual dysfunction
20 = perceptual dysfunction	30 = intact central processing
30 = intact central processing	
Maximum score = 30 points	Maximum score = 30 points

Intellectual Factors

Raven's Standard Progressive Matrices (1960) was administered to the subjects in order to obtain a rating for the Intellectual Factors variable. Obtaining the consent of the schools to test their students was contingent upon limited testing time. The Standard Progressive Matrices was therefore selected since it is a quick and easy test to administer. Because it is a nonverbal test, the directions could be understood without verbal instructions and the subjects could perform the test without requiring oral output or specific verbal skills. The test is comprised of 60 untimed multiple choice problems, each consisting of a design or "matrix" from which a part has been removed (Shipley, 1949). The task is to examine the matrix and select the correct part for completing it. The easier problems draw principally on discrimination skills, the more difficult ones on reasoning by analogy. In his review of the Progressive Matrices, Shipley (1949, p. 338) wrote,

> The test has much to commend it. Since the content is limited to highly abstract material which is largely foreign either to the classroom or to everyday experience, it is highly probable that what is being measured relates more directly to 'native' abstract intelligence and less to academic achievement, educational opportunity, or cultural background than is the case with most tests of general intelligence.

Testing was conducted on an individual basis in order to ensure that the instructions were understood by all subjects. No other tests were administered on the same day. The 1956 version of the Standard Progressive Matrices was used. The instructions for the test followed the recommendations outlined by Raven (1960). In addition to the standard instructions, nonverbal gestures were used to reinforce the verbal directions with all the subjects. Each subject completed all 60 problems. The raw scores were converted to percentile points according to the norms table for the individual test (Raven, 1960, p. 14). The percentile scores were divided into three groups based on Raven's (1960, p. 11) classification of the percentile points: (a) above average with scores above the 75th percentile, (b) average with scores lying between the 25th and 75th percentiles, and (c) below average with scores below the 25th percentile.

The Intellectual Factors variable was scored in the same manner on both the D-DMQ and M-DMQ: subjects in the "above average" group received 20 points; 10 points were awarded to children in the "average" group; and no credit was earned in the "below average" group. Table 9 represents the allotment of points on the two quotients for the Intellectual Factors variable.

Insert Table 9 about here

Family Constellation

In order to obtain a measure of parental support, a questionnaire was devised and forwarded by mail to each set of parents of the subjects. The questionnaire was based on one published by Brown (1971) which was an information and attitude scale for parents of hearing-impaired children. Brown's questionnaire was used in full and to it were randomly added several other relevant questions. Appendix A presents the questionnaire in full. Questions that were added to Brown's original version are marked by an asterisk. The questionnaire was translated into several languages for the parents who were unable to speak and read English, including French, Hungarian, Italian and

Table 9

Distribution of Points for the Intellectual Factors Variable

on the D-DMQ and M-DMQ

D-DMQ	M-DMQ
0 = mentally retarded (IQ < 85)	0 = below average
10 = average (IQ = 85-100)	10 = average
20 = above average (IQ > 100)	20 = above average
Maximum score = 20 points	Maximum score = 20 points

Spanish. The translated versions are presented in Appendices B, C, D, and E. The questionnaires were mailed to the parents with a stamped, self-addressed return envelope and were returned to the author upon completion. The parents who failed to return the questionnaire within several weeks were called and encouraged to do so. Eventually, the questionnaires from all the parents were received. The questionnaires were scored subjectively by two raters, the author and an independent rater, an associate professor of Educational Psychology at McGill University. Pearson correlation coefficients were obtained in order to test the inter-rater reliability. The correlations were performed separately for the two schools. The inter-rater reliability correlation coefficient was .93 for the ratings from both the Mackay Center and the MOSD. For each subject, the scores from the two raters were averaged to form the Family Constellation score since the correlation between the two raters was so high. Percentage of agreement was used as a second measurement since it is possible to have high Pearson correlation coefficients with low agreement among the scores. For example, in the extreme case, one set of numbers can be a multiple of the other set, thereby obtaining strong correlation between them while the actual agreement would not be strong. The percentage of agreement between raters for identical ratings was 60% at Mackay Center and 59% at the MOSD. It was necessary to calculate percentage of agreement using identical ratings since the interval between raters was never greater than plus or minus five. The D-DMQ Family Constellation scores were interpolated to correspond to the ratings obtained on the M-DMQ. Table 10 represents the transformed scores.

Insert Table 10 about here

Table 10

Comparison of Corresponding Scores Obtained for the Family Constellation Variable on the D-DMQ and M-DMQ

D-DMQ	M-DMQ
0	0
1.67	5
3.34	10
5.01	15
6.68	20
8.35	25
10	30

Values for the Family Constellation variable on the D-DMQ ranged from a minimum of 0 indicating lack of support to a maximum of 10 points representing highly supportive parents. Values for this variable on the M-DMQ ranged from 0 to 30 divided by intervals of five. The distribution of points for the Family Constellation variable is presented in Table 11.

Insert Table 11 about here

Socioeconomic Situation

This variable assessed whether or not the parents of the subjects had sufficient income to enable them to care for their child's special needs, such as purchasing hearing aids or servicing the aids. Since none of the parents was on welfare, and in all cases at least one spouse was employed full-time, it was decided to allot full credit to all subjects on the Socioeconomic Situation variable. This decision was reinforced by the fact that educational programs for the hearing impaired and visits to audiology clinics in the province of Quebec are free of charge and financial aid for purchasing hearing aids is readily available. Thus, all subjects received 10 points on the D-DMQ Socioeconomic Situation variable and 5 points on the M-DMQ. Table 12 illustrates the allotment of points for the Socioeconomic Situation variable on the D-DMQ and M-DMQ.

Insert Table 12 about here

The following four variables were included solely on the M-DMQ.

Linguistic Differences

Documentation of any differences between the language of education (English) and the language spoken at home were obtained from the questionnaires

Table 11

Allotment of Points for the Family Constellation Variable

on the D-DMQ and M-DMQ

D-DMQ	M-DMQ
0 = no support	0-5 = inadequate
10 = completely supportive and understanding	10-15 = fair
	20-25 = good
	30 = completely supportive educationally and emotionally
Maximum score = 10	Maximum score = 30

Table 12

Assignment of Points for the Socioeconomic Situation Variable

on the D-DMQ and M-DMQ

D-DMQ	M-DMQ
0 = substandard	0 = substandard
10 = completely adequate	5 = adequate
Maximum score = 10 points	Maximum score = 5 points

sent to the parents of the subjects. This information was verified by reports from the childrens' teachers. A maximum of 15 points was granted in the case of no linguistic differences and the minimum score of 0 signified that neither parent spoke English. Table 13 represents the distribution of points on the Linguistic Differences variable.

Insert Table 13 about here

Additional Physical Handicaps

Information concerning the presence of physical handicaps in addition to that of a hearing loss was obtained from the subjects' medical files. In most cases, additional physical handicaps were readily observable. A "moderate physical handicap" included, for example, the presence of a visual problem other than myopia, such as strabismus. Severe spina bifida, hydrocephalus or paraplegia were considered "severe physical handicaps." A score of 10 represented no additional physical handicaps while a score of 0 indicated the presence of a severe physical handicap. The allotment of points on the Additional Physical Handicaps variable is presented in Table 13 (see p. 82).

Amplification

The age of 2 was selected as the critical age for commencing amplification since the average age of a child when a hearing loss is diagnosed is 1.5 to 2.5 years (Northern and Downs, 1974; Shah, Dale & Chandler, 1977). The upper limit of age 3 was chosen since the development of auditory-oral skills depends largely on maximal exposure to language and speech from infancy to the age of 3 (Ling, 1975b; Shah et al., 1977). The maximum score of 10 points was therefore allotted to subjects who received amplification by the age of 2 years, 5 points were granted to children who were fitted with hearing aids by the age

Table 13

The Four Additional Variables on the M-DMQ

Linguistic Differences	
0 =	parents speak no English
5 =	parents speak some English, but generally not at home
10 =	parents speak a language other than English to each other, but speak English with their hearing-impaired child
15 =	no linguistic differences
	Maximum score = 15 points
Additional Physical Handicaps	
0 =	severe
5 =	moderate
10 =	no additional physical handicaps
	Maximum score = 10 points
Amplification	
0 =	after the age of 3
5 =	by the age of 3
10 =	by the age of 2
	Maximum score = 10 points
Mode of Communication	
0 =	only gestures or signs
2.5 =	single words and phrases in speech, but mainly gestures or signs
5 =	some speech with many gestures or signs
7.5 =	speech with minimal use of gestures or signs
10 =	speech only
	Maximum score = 10 points

of 3, and no credit was earned by subjects who received amplification after the age of 3 years. The information regarding the age of the child when he was initially fitted with hearing aids was derived by directly questioning the parents over the telephone. An interpreter speaking the appropriate language made the phone calls when neither parent could speak English or French. Table 13 (see p. 82) represents the distribution of points on the Amplification variable.

Mode of Communication

The information concerning how the subjects communicated at home in terms of relative usage of speech and sign language was derived from the questionnaires sent to the parents. The maximum score obtainable was 10 points when speech was the exclusive mode of communication at home. No points were granted to the child whose medium of communication at home was exclusively via signs or gestures. Table 13 (see p. 82) illustrates the distribution of points on the Mode of Communication variable.

Dependent Measures

Three dependent measures were used in the present study. Two reading/language tests were selected from the Stanford Achievement Test, Primary Level II Reading Test, Form A, 1973 edition. Testing of the subjects' speech skills was accomplished using Ling's (1976) Phonetic Level Speech Evaluation (PLSE).

Stanford Achievement Test. In his review of the Stanford Achievement Test, Ebel (1978, p. 98) wrote,

> All in all, the 1973 edition of the Stanford Achievement Test embodies most of the best that is currently known about the measurement of educational achievement. The test is comprehensive across areas of instructional emphasis and over a wide range of grade levels. The test content

was carefully planned with advice from expert teachers. The items were carefully written, painstakingly reviewed and revised on the basis of tryout data.

The remaining three reviewers of the Stanford Achievement Test (Passow, Lehmann & Kasdon, 1978) all concluded that the 1973 edition was among the best available for the ongoing assessment of basic skills and academic achievement in the elementary and junior high school grades.

Primary Level II was selected as a suitable level for the subjects in the present study, based on the consensus of opinions of the teachers who were consulted. The teachers were asked to recommend a level which would fairly evaluate the children's skills without achieving a ceiling effect.

Only one of the three reading tests was chosen due to time restrictions: Reading: Part A (word reading) and Reading: Part B (reading comprehension of paragraphs), to be referred to as SATa and SATb respectively. The reading tests were administered at the same setting on an individual basis. No other test was given that same day.

Phonetic Level Speech Evaluation. This test was selected as a measurement of the subjects' speech skills since it is the only available phonetic (imitative) speech evaluation. Ling (1976) explained that in order for sound patterns to be accurately incorporated into a child's speech, they must initially be present in the phonetic repertoire. "Phonetic level evaluation is therefore required to determine the extent to which particular sound patterns are present, the stage at which the child can differentiate one motor speech pattern from another, and the rate at which sounds can be repeated and alternated" (p. 147). Standard articulation tests which use pictures of words to elicit the production of specific speech sounds do not evaluate the consonants in all vowel contexts. The articulation tests which use meaningful stimuli also have questionable validity as measures of speech skill unless language acquisition is quite advanced (Ling, 1976). In addition, speech elicited from pictures tends to contain distortions which reflect the child's syntactic or morphological incompetence rather than his inability to produce adequate speech patterns. Furthermore, the standard articulation test requires that the child produce the words by naming the pictures--a task which would be too difficult for many of the subjects in the present study. The PLSE is also simple to administer and quick and easy to score. The test is illustrated in Appendix F.

An experienced speech pathologist who had previously worked with hearing-impaired children administered the tests. Testing proceeded according to the instructions outlined by Ling (1976) as well as those printed on the test itself. Where necessary, additional visual, auditory and tactile cues were provided. Testing was discontinued when five consonants within a "step" were in error, i.e., if both single and repeated syllables were produced incorrectly. An error was defined as any production that deviated from standard English articulation as judged by the experienced speech pathologist. Initially, all children were asked to produce the target vowel or consonant, given an auditory stimulus. A visual cue indicating placement was occasionally used with the subjects from the MOSD; for example, a movement at the back of the throat for the child who confused a "t" with a "k." The procedure was altered slightly with the MacKay Center children to accommodate their total communication approach. A bilingual signer/speaker aided the examiner by presenting all verbal instructions accompanied by sign language. To further aid the subjects, specific targets that were also words such as "me" were signed. In addition, the Northampton Chart, with which the children were familiar, was used with all vowels and consonant-vowel combinations that were unclear. The Northampton Chart is a system of orthography which originated at the Clarke School for the Deaf (Davis & Silverman, 1970). This system carries more information about speech units than do the unrelated letters of the English alphabet by arranging the symbols in columns and rows according to the place of production of the sounds. For example, the consonants "p," "b" and "m" are in the same row because all three require initial lip closure for their production. However, they are in different columns because the production of "p" does not require use of the vocal cords, while the production of "b" does, and "m" is a nasal sound. The multiplicity of letters and combinations of letters that represent the same sound are handled by arranging secondary spellings under the primary symbol, which is the one that occurs most frequently in the English usage. Table 14 illustrates the Northampton consonant and vowel charts.

Insert Table 14 about here

The PLSE was administered on an individual basis. No other test was given on that same day. Scoring of the test was as follows: Each consistently correct response was awarded two points while one point was granted for an inconsistent (occasionally correct) response. The final score was the sum of all the points.

Table 14

The Northampton Consonant and Vowel Charts

CONSONANT SOUNDS

h—				
wh	w—			
p	b	m		
t	d	n	l	r-
k ck c	g	ng		
f ph	v			
th	th			
s c(e) c(i) c(y)	z s			
sh	zh	y—		
ch tch	j g— —ge dge		x = ks	qu = kwh

VOWEL SOUNDS

oo (r) u—e (r) ew	oo	o—e oa —o ow	aw au o(r)	—o—	
ee —e ea e—e	—i— —y	a—e ai ay	—e— ea	—a—	
	a(r)	—u— —a	ur er ir		
a—e ai ay	i—e igh —y	o—e oa —o ow	ou ow	oi oy	u—e ew

In the consonant chart the left-hand column is occupied by the English breath consonants; the second column, by the voiced forms of the same sounds; the third, by the nasal sounds. The horizontal arrangement classifies these sounds according to formation. A dash following a letter indicates that the sound is initial in a word or syllable.

Fig. 16-6B. The Northampton Vowel Chart. In the vowel chart the upper line contains the back round vowels (those modified chiefly by the back of the tongue and the rounded aperture of the lips). The second line contains the front vowels (those modified chiefly by the front of the tongue). Remaining vowels are in the third line. The lowest line contains all the diphthongal sounds. Although ā and ō appear in the rows to which their radical (long component) parts belong, they are repeated here because their compound nature makes them diphthongs also.

An attempt is also made in these charts to teach the simple rules of pronunciation. For illustration, *a-e* (representing *ā*) when contrasted with *-a-* (representing *ă*), is easily made intelligible by the introduction of the same consonants in both sets of blanks: *rate*, *rat*; *hate*, *hat*, and so on. Children will not find diacritical marks over the words in their books or in other material, but if they are familiar with the principles of pronunciation represented here, they will know that final *e* modifies the sound of the vowel preceding it, making *a*, *ā*; *e*, *ē*; *i*, *ī*; *o*, *ō*. The secondary spellings under each sound generally indicate frequently occurring variations for those sounds. Numbers above the sounds differentiate pronunciations for similar spellings. In this way words are made to pronounce themselves to the eye of the child. Eventually, the children learn the diacritical marks of the dictionary.

Note: From Davis and Silverman, 1970, p. 406.

Chapter III

RESULTS AND CONCLUSIONS

Mean Scores

The mean scores and standard deviations of the subjects on all the variables included in the original and modified Deafness Management Quotients are presented in Table 15.

Insert Table 15 about here

The mean scores and standard deviations of the dependent measures SATa, SATb and the PLSE are presented in Table 16.

Insert Table 16 about here

Although the figures clearly indicate the superiority of the MOSD scores, it is not the intention of the present study to dwell on these differences which may arise from a variety of causes, notably differences between the two schools in terms of teaching methods, the quality of the educational programs and student selection. Hearing-impaired children who demonstrate early oral skills would more likely select the MOSD. These children would probably emerge as more successful academically. Furthermore, the MOSD tends not to accept hearing-impaired children with additional physical handicaps. These effects cannot be separated in the present study. While possibly important, the differences between the schools are irrelevant for the purposes of the current investigation.

Table 15

Mean Scores and Standard Deviations on the

D-DMQ and M-DMQ Variables

Variables (Maximum Possible Scores)	Mackay Center $\bar{X}$	Mackay Center SD	MOSD $\bar{X}$	MOSD SD
D-DMQ Variables				
Residual Hearing (30)	12.1	10.3	20.5	12.5
Central Intactness (30)	24.7	9.6	22.7	10.3
Intellectual Factors (20)	9.5	7.1	14.1	5.9
Family Constellation (10)	3.4	3.2	4.9	2.8
Socioeconomic Situation (10)	10.0	0.0	10.0	0.0
D-DMQ Total (100)	59.7	15.5	72.1	15.8
M-DMQ Variables				
Residual Hearing (30 + 20)	12.4	11.6	25.5	17.1
Central Intactness (30)	23.7	10.4	21.1	11.0
Intellectual Factors (20)	9.5	7.1	14.1	5.9
Family Constellation (30)	10.3	9.7	15.5	9.1
Socioeconomic Situation (5)	5.0	0.0	5.0	0.0
Linguistic Differences (15)	8.2	7.3	11.4	5.4
Physical Handicaps (10)	8.4	3.4	9.8	1.1
Amplification (10)	3.2	4.5	4.8	4.2
Mode of Communication (10)	4.6	3.3	8.9	1.3
M-DMQ Total (180)	85.1	24.1	115.0	15.6

Table 16

Mean Scores and Standard Deviations on the

Three Dependent Measures

Dependent Measures	Mackay Center $\bar{x}$	Mackay Center SD	MOSD $\bar{x}$	MOSD SD
SATa	20.3	7.0	33.3	8.1
SATb	15.4	4.4	24.3	11.0
PLSE	120.9	86.2	260.0	119.1

Analyses of Variance

Three two-way analyses of variance were conducted in order to determine whether there were differences among the three age groups in terms of the dependent measures. The Statistical Package for the Social Sciences (SPSS) was used (Nie, Hull, Jenkins, Steinbrenner & Bent, 1975) for these analyses. As Tables 17-19 indicate, there were no significant differences among the age groups on any of the three dependent measures.

Insert Tables 17-19 about here

Therefore, in the discussion of the results, subjects are not divided according to age. Significant differences were once again confirmed between schools on the dependent measures.

Kendall Rank Correlation Analyses

In order to determine the relations among the DMQ variables and the three dependent measures, Kendall rank correlation coefficients were obtained. The Kendall rank correlation procedure was used because some of the data were nonparametric. In order to control the effects of variation by chronological age on the relation between the DMQ variables and the dependent measures, the Kendall partial rank correlation procedure was employed, keeping chronological age constant (Siegel, 1956), even though no significant age differences were found. Socioeconomic Situation was not included in the analyses since the points allotted for it were constant for all the subjects. Results of the Kendall rank correlations for both the D-DMQ and M-DMQ appear in Tables 20 and 21.

Insert Tables 20 and 21 about here

Table 17

Analysis of Variance: Effects of Age

on SATa Performance

Source	Mean Square	df	F	Significance Level
Main Effects	613.45	3	10.09	0.00**
School	1647.34	1	27.08	0.00**
Age	58.38	2	0.96	0.39
2-Way Interactions	4.63	2	0.08	0.93
School by Age	4.63	2	0.08	0.93
Explained	369.92	5	6.08	0.00
Residual	60.83	35		
Total	99.46	40		

$^{**}p < .01$

Table 18

Analysis of Variance: Effects of Age on SATb Performance

Source	Mean Square	df	F	Significance Level
Main Effects	353.78	3	4.89	0.01**
School	716.41	1	9.90	0.00**
Age	122.36	2	1.69	0.20
2-Way Interactions	61.17	2	0.85	0.44
School by Age	61.17	2	0.85	0.44
Explained	236.73	5	3.27	0.02
Residual	72.35	35		
Total	92.90	40		

**p < .01

Table 19

Analysis of Variance: Effects of Age

on PLSE Performance

Source	Mean Square	df	F	Significance Level
Main Effects	70737.81	3	6.04	0.00**
School	183014.38	1	15.62	0.00**
Age	7477.72	2	0.64	0.53
2-Way Interactions	3287.25	2	0.28	0.76
School by Age	3287.25	2	0.28	0.76
Explained	43757.59	5	3.73	0.01
Residual	11718.43	35		
Total	15723.32	40		

$^{**}p < .01$

Table 20

Kendall Rank Correlation Coefficients between the D-DMQ

Variables and the Dependent Measures

		RH	CI	IF	FC
SATa	Mackay	-.11	.12	.24	.16
	MOSD	.01	.50**	.55**	.04
SATb	Mackay	-.19	.12	.43**	.13
	MOSD	.05	.57**	.57**	.04
PLSE	Mackay	.40**	.12	.10	-.25
	MOSD	.44**	.49**	.20	-.25*

*$p < .05$

**$p < .01$

Variables:

RH = Residual Hearing

CI = Central Intactness

IF = Intellectual Factors

FC = Family Constellation

Table 21

Kendall Rank Correlation Coefficients between the M-DMQ Variables and the Dependent Measures

		RH	CI	IF	FC	LD	PH	AMP	MC
SATa	Mackay	-.04	.12	.24	.16	.11	.20	.32*	.05
	MOSD	.14	.50**	.55**	.04	-.01	.54**	-.04	.42**
SATb	Mackay	-.21	.11	.43**	.13	-.10	.29*	.29*	-.12
	MOSD	.12	.57**	.57**	.04	.05	.86**	.05	.38**
PLSE	Mackay	.43**	.12	.10	-.25	.51**	.43**	-.17	.28*
	MOSD	.51**	.49**	.20	-.25**	-.18	.20	-.31*	.55**

*$p < .05$

**$p < .01$

Variables:

RH = Residual Hearing

CI = Central Intactness

IF = Intellectual Factors

FC = Family Constellation

LD = Linguistic Differences

PH = Physical Handicaps

AMP = Amplification

MC = Mode of Communication

Note. Socioeconomic Situation could not be computed since all values were constant.

Kendall partial rank correlation coefficients were computed, but it was found that they were almost identical to the Kendall rank correlation coefficients. In addition, significance tables were not available for Kendall partial rank correlation coefficients. Consequently, the Kendall partial rank correlation coefficients are not reported.

The results indicated that the Kendall rank coefficients of correlation between the dependent variables and the independent variables on the D-DMQ ranged from a minimum negative value of -.25 (Family Constellation and the PLSE) to a maximum value of .57 (Intellectual Factors and the SATb). Thirty-eight percent of the correlation coefficients were significant at the .05 level or better.

Four Kendall rank correlations were negative; of these, the MOSD Family Constellation and the PLSE correlation were significant at the .05 level. The significant negative correlation obtained between degree of family support and scores on the speech test suggests that the responses of some parents may not have reflected their true feelings. It may be that the parents who received the highest scores on the Family Constellation questionnaires were those who made a special attempt to appear very supportive, but in reality were lacking the necessary skills. Defensive about their lack of emotional or educational supportiveness, these parents may have been more intent than the truly supportive parents in attempting to present themselves in a better light to the professional who was questioning them. Thus, the results would reflect high scores from parents who were non-supportive, possibly contributing to the significant negative correlation.

Of the nine significant coefficients, only two were from Mackay Center data; these included Intellectual Factors with the SATb and Residual Hearing with the PLSE. Significant positive MOSD coefficients were the following: Central Intactness with the SATa, the SATb, and the PLSE, Intellectual Factors with the SATa and the SATb, and Residual Hearing with the PLSE.

The analysis of the M-DMQ data revealed that Kendall rank coefficients of correlation between the dependent variables and the independent variables ranged from a minimum value of -.31 (Amplification and the PLSE) to a maximum value of .86 (Physical Handicaps and the SATb). Thirty-eight percent of the correlation coefficients were significant at equal to or better than the .05 level. Of the 18 significant coefficients, seven were represented by Mackay Center data.

Eleven Kendall rank correlations were negative; of these, two from the MOSD data were significant, including Amplification with the PLSE at the .05 level and Family Constellation with the PLSE at the .01 level. An attempt to explain the significant negative correlation between Family Constellation and the PLSE was made previously. Regarding the significant negative correlation between Amplification and the PLSE, it is possible that the children who received their hearing aids at an older age wore them more regularly. In addition, these children were presumably more mature and were better able to realize the benefits of their hearing aids. Thus, it may have been these older children who received the higher scores on the test of their speech skills. It is also possible that the Amplification variable did not take into consideration the age at which hearing aids were worn consistently and checked on a regular basis. Some children may have been fitted with aids years before they began to wear them regularly. This would explain why the children who received their hearing aids at an earlier age had lower scores on the dependent measures since they may not have actually been wearing their aids until they were older. The significant negative correlation between Amplification and the PLSE was observed only in the data from the MOSD. The reason for this occurrence is that very few subjects from Mackay Center received their hearing aids before the age of 3.

Table 21 demonstrated that the M-DMQ scale yielded significant correlations that were similar to those which emerged from the D-DMQ data in terms of the variables that were common to both quotients; that is, Central Intactness and Intellectual Factors with the SATa (MOSD only); Central Intactness (MOSD) and Intellectual Factors (MOSD and Mackay Center) with the SATb; Central Intactness (MOSD), Residual Hearing (MOSD and Mackay Center) and Family Constellation (MOSD, negative relation) with the PLSE.

Results from the M-DMQ data in terms of the four additional variables revealed the following significant correlations: Physical Handicaps with the SATa (MOSD), the SATb (MOSD and Mackay Center) and the PLSE (Mackay Center); Amplification with the SATa (Mackay Center), SATb (Mackay Center) and the PLSE (MOSD, negative relation); Mode of Communication with the SATa (MOSD), the SATb (MOSD) and the PLSE (MOSD and Mackay Center); and finally, Linguistic Differences with the PLSE (Mackay Center). No discernible pattern of results emerged other than Linguistic Differences having the fewest significant correlations with the dependent variables and Physical Handicaps and Mode of Communication having the most.

Pearson Correlation Analyses

Pearson correlation coefficients were obtained for the Mackay Center and the MOSD, correlating the D-DMQ totals, chronological age and the three dependent measures, the SATa, the SATb and the PLSE. Corresponding Pearson correlation coefficients were obtained with the above variables and the M-DMQ totals. Table 22 presents the results of the Pearson correlation analyses.

Insert Table 22 about here

It was predicted that the correlations among the M-DMQ totals and the dependent measures would be higher than those among the D-DMQ totals and the dependent measures. This prediction was based on the fact that the M-DMQ incorporated a greater number of factors and should therefore have reflected the children's academic achievements more precisely.

In order to eliminate the influence of chronological age on the dependent measures and the DMQ totals, partial correlations were used with both DMQ's. The results appear in Table 23.

Insert Table 23 about here

The results demonstrated that with the effects of age partialed out, 50% of the D-DMQ correlation coefficients were significant at the .05 level or better. Of the six significant coefficients only one emerged from the Mackay Center data. Sixty-seven percent of the M-DMQ correlation coefficients were significant at equal to or better than the .05 level. Of these significant coefficients, only 17% were from the Mackay Center data.

The data revealed that the SATa and the SATb results correlated well

Table 22

Pearson Correlation Coefficients among the Dependent Measures, DMQ Totals and Chronological Age

	Age	SATa	SATb	PLSE	DMQ Total
Age		1) .17	1) .15	1) -0.04	1) -.02
		2) .17	2) .15	2) -0.04	2) .06
		3) .35	3) .46*	3) .26	3) .31
		4) .35	4) .46*	4) .26	4) .46*
SATa			1) .62**	1) .16	1) .33
			2) .62**	2) .16	2) .42
			3) .85**	3) .59**	3) .41*
			4) .85**	4) .59**	4) .51**
SATb				1) .00	1) .23
				2) .00	2) .19
				3) .63**	3) .52**
				4) .63**	4) .69**
PLSE					1) .38
					2) .49*
					3) .56**
					4) .57**

*p < .05

**p < .01

Key:

1) Mackay Center, D-DMQ
2) Mackay Center, M-DMQ
3) MOSD, D-DMQ
4) MOSD, M-DMQ

Table 23

Partial Correlation Coefficients between the Dependent Measures and the DMQ Totals

	SATa	SATb	PLSE	DMQ Total
SATa		1) .61**	1) .17	1) .34
		2) .61**	2) .17	2) .34
		3) .82**	3) .55**	3) .42
		4) .82**	4) .55**	4) .42*
SATb			1) .01	1) .23
			2) .01	2) .19
			3) .60**	3) .45*
			4) .60**	4) .61**
PLSE				1) .38
				2) .50*
				3) .52**
				4) .52**
DMQ Total				

* $p < .05$

** $p < .01$

Key:

1) Mackay Center, D-DMQ
2) Mackay Center, M-DMQ
3) MOSD, D-DMQ
4) MOSD, M-DMQ

at both schools. The SATa and SATb both correlated well with the PLSE scores, but only at the MOSD. This is a predictable result since language and speech skills received similar emphasis at the MOSD, whereas speech instruction was of lesser importance at Mackay Center, at least at the time the data were gathered.

Both the PLSE and the SATb scores correlated significantly with D-DMQ and M-DMQ total scores from MOSD subjects; however, the correlation were somewhat stronger with the M-DMQ. SATa scores correlated significantly only with the M-DMQ total scores of MOSD subjects. A significant correlation was obtained between the M-DMQ total scores and the PLSE with Mackay Center data.

In general, the Pearson correlations revealed that the M-DMQ scale correlated somewhat better with the dependent measures than did the D-DMQ. Thus, it appears that one or all of the changes incorporated in the M-DMQ such as the addition of four variables, the different weights allotted to the variables, and the alteration of the Residual Hearing variable may have resulted in a scale which correlates better with the tests of speech and reading comprehension. In addition, a greater number of significant correlations were obtained from MOSD data than from the Mackay Center, suggesting that the MOSD has a more homogeneous population due to their student selection; Mackay Center has more lenient admission criteria in that they accept children with additional physical handicaps. In addition, MOSD children receive earlier and more intensive specific speech training than do their counterparts at Mackay Center.

Multiple Regression Analysis I

The present investigation set out to determine whether or not the Deafness Management Quotient and its modified version were useful predictive instruments. This question could be examined only by investigating the individual variables included in the quotients. The current study was also designed to compare the two quotients with respect to the five variables common to both scales.

In order to determine how well the five variables common to the two quotients predicted the children's performance scores, a regression analysis was conducted. The five common variables were Residual Hearing, Central Intactness, Intellectual Factors, Family Constellation, and Socioeconomic Situation. Of these five variables, Residual Hearing was the only one that was computed differently and was assigned a greater weighting on the M-DMQ. Family Constellation scores were interpolated from the M-DMQ to the D-DMQ, but received a greater weighting on the M-DMQ. Calculations for the Socioeconomic Situation variable were the same on the two quotients, but different weights were assigned to the scores on the M-DMQ. Central Intactness and Intellectual Factors were computed in a similar manner on both quotients.

The SPSS subprogram Regression using stepwise multiple regression was applied to the five independent variables common to both the D-DMQ and M-DMQ in the correlation matrix. A separate program was computed for the D-DMQ and the M-DMQ.

Tables 24 and 25 illustrate the results of the overall analysis of variance for the regression analysis for the five independent variables on both quotients.

Insert Tables 24 and 25 about here

The results suggest that the variables as a whole on both quotients were significant predictors of the dependent measures. However, the overall

Table 24

Overall Analysis of Variance for the Regression Analysis for the D-DMQ

Dependent Variables	Mean Square	F
SATa	439.24	7.12**
Error	61.71	
SATb	349.93	5.44**
Error	64.34	
PLSE	72646.41	7.73**
Error	9398.56	

**p (4, 36) < .01

Table 25

Overall Analysis of Variance for the Regression Analysis

for the Common Independent Variables on the M-DMQ

Dependent Variables	Mean Square	F
SATa	464.18	7.88**
Error	58.94	
SATb	369.12	5.93**
Error	62.20	
PLSE	89312.79	11.83**
Error	7546.74	

**p (4,36) < .01

results are merely a reflection of the individual components that were significant. Thus, individual variables on both quotients must be examined before any conclusions can be made.

A stepwise multiple regression analysis was performed in order to determine the ability of the variables common to the D-DMQ and the M-DMQ to predict performance on the dependent measures. The variables were entered into the regression equation according to the weights assigned to them by the two DMQ's. Variables with the highest weights were entered first and those with the lowest weights were entered last. Thus, D-DMQ variables were entered in the following order: Residual Hearing, Central Intactness, Intellectual Factors, Family Constellation and finally, Socioeconomic Situation. Variables on the M-DMQ which were common to both quotients were entered in the following order: Residual Hearing, Family Constellation, Central Intactness, Intellectual Factors and Socioeconomic Situation.

Tables 26-31 present summaries of the regression analyses for the dependent measures and the variables common to both DMQ scales. In Tables 26-31, the variables are listed according to the order in which they emerged from the computer arranged by the stepwise regression analysis. Socioeconomic Situation was not included in the analyses since values for this variable were constant for all the subjects.

In Tables 26 and 27, the results of the regression analysis for the dependent variable SATa are presented.

Insert Tables 26 and 27 about here

Table 26 illustrates results from the D-DMQ indicating that the prediction equation contained three significant values and accounted for 44% of the

Table 26

Summary of Cumulative Multiple Correlations and Raw Regression Coefficients for the SATa Predicted by the D-DMQ

D-DMQ Variables (Predictors)	Multiple R	R^2	Regression Coefficient β	F Ratio
Intellectual Factors	.52	.27	.79	16.35**
Residual Hearing	.57	.33	.28	6.88*
Family Constellation	.66	.43	1.13	7.10*
Central Intactness	.66	.44	.12	.81
Socioeconomic Situation	Could not be computed since all values were constant			

*p (1,36) < .05

**p (1,36) < .01

Table 27

Summary of Cumulative Multiple Correlations and Raw Regression Coefficients for the SATa Predicted by the Common Variables on the M-DMQ

M-DMQ Variables (Predictors)	Multiple R	R^2	Regression Coefficient β	F Ratio
Intellectual Factors	.52	.27	.71	13.79**
Residual Hearing	.60	.36	.24	9.26**
Family Constellation	.67	.45	.36	7.00*
Central Intactness	.68	.47	.13	1.03
Socioeconomic Situation	Could not be computed since all values were constant			

*p (1,36) < .05

**p (1,36) < .01

variance. The variable, Residual Hearing, was entered first into the stepwise multiple regression analysis and was significant at the .05 level. Residual Hearing was a good predictor of performance on the SATa, accounting for 6% of the total variance. Central Intactness accounted for 1% of the remaining variance; Intellectual Factors, significant at the .01 level, accounted for an additional 27% of the variance; Family Constellation, significant at the .05 level, accounted for an additional 10% of the variance.

Table 27, which illustrates performance on the SATa as predicted by the M-DMQ variables which were common to both quotients, revealed that similar results to the D-DMQ were obtained for all variables with the exception of Residual Hearing whose significance level was higher when Tables 26 and 27 are compared. The prediction equation contained three significant values and accounted for 48% of the variance. Residual Hearing, entered first in the stepwise multiple regression analysis, accounted for 10% of the total variance and was significant at the .01 level. Family Constellation, significant at the .05 level, accounted for 9% of the remaining variance; Central Intactness accounted for 2% of the remaining variance; Intellectual Factors accounted for an additional 27% of the variance and was significant at the .01 level. The increased importance of Residual Hearing as a predictor on the M-DMQ may be ascribed to the fact that additional information was collected for this variable on the M-DMQ than on the D-DMQ by taking hearing-level differences between the two ears and type of hearing loss into consideration.

The results of the regression analysis for the dependent variable SATb are presented in Tables 28 and 29.

Insert Tables 28 and 29 about here

Table 28

Summary of Cumulative Multiple Correlations and Raw Regression Coefficients for the SATb Predicted by the D-DMQ

D-DMQ Variables (Predictors)	Multiple R	R^2	Regression Coefficient β	F Ratio
Intellectual Factors	.48	.23	.64	10.27**
Residual Hearing	.52	.27	.22	3.88
Family Constellation	.57	.32	.85	3.83
Central Intactness	.61	.38	.24	3.04
Socioeconomic Situation	Could not be computed since all values were constant			

*p (1,36) < .05

**p (1,36) < .01

Table 29

Summary of Cumulative Multiple Correlations and Raw Regression Coefficients for the SATb Predicted by the Common Variables on the M-DMQ

M-DMQ (Predictors)	Multiple $\underline{R}$	$\underline{R}^2$	Regression Coefficient $\underline{\beta}$	F Ratio
Intellectual Factors	.48	.23	.58	8.78**
Residual Hearing	.56	.31	.19	5.50*
Central Intactness	.59	.34	.24	3.49
Family Constellation	.63	.40	.25	3.16
Socioeconomic Situation	Could not be computed since all values were constant			

*$\underline{p}$ (1,36) < .05

**$\underline{p}$ (1,36) < .01

Performance on the SATb as predicted by the variables on the D-DMQ is illustrated in Table 28. Residual Hearing, entered first in the stepwise multiple regression, accounted for 4% of the total variance; Central Intactness accounted for 5% of the remaining variance; Intellectual Factors, significant at the .01 level, accounted for 23% of the remaining variance; and Family Constellation accounted for an additional 5% of the variance. The prediction equation contained one significant value and accounted for 37% of the total variance.

Performance on the SATb as predicted by the first five variables on the M-DMQ was examined in Table 29, indicating that similar results were obtained for all the variables except Residual Hearing which was significant at the .05 level. Presumably, the rationale for this finding is the same as that suggested following Table 28, in that additional information was obtained for the Residual Hearing variable on the M-DMQ as compared to its counterpart on the D-DMQ. The prediction equation for the SATb on the M-DMQ contained two significant values and accounted for 39% of the variance with Residual Hearing accounting for 7% of the total variance; Family Constellation accounting for an additional 5% of the variance; Central Intactness, an additional 4%, and Intellectual Factors, an additional 23%.

Results from Tables 26-29 reveal, in general, that the independent variables were more successful in predicting the SATa results than the SATb scores. The SATa is a reading comprehension test requiring the association of a picture with relevant nouns and verbs. The SATb is a reading comprehension test which examines reading in the context of a short paragraph. It is possible that the predictive results were superior for the SATa due to simpler performance demands of this test which may have more accurately reflected the subjects' language processing skills at the time.

The results of the regression analyses for the dependent variable PLSE appear in Tables 30 and 31.

Insert Tables 30 and 31 about here

Performance on the PLSE as predicted by the various factors on the D-DMQ is presented in Table 30. Residual Hearing, entered first in the stepwise multiple regression analysis, was significant at the .01 level, and accounted for 35% of the overall variance. Intellectual Factors was significant at the .05 level, and accounted for an additional 10% of the variance. Neither Central Intactness nor Family Constellation was significant and both contributed less than an additional 2% of the remaining variance. The prediction equation accounted for 46% of the variance and contained two significant values.

In Table 31, performance on the PLSE is presented as predicted by the first five variables on the M-DMQ. Residual Hearing, entered first in the stepwise regression analysis, was also significant at the .01 level, but in this case accounted for 49% of the overall variance. Intellectual Factors, though not significant, accounted for 7% of the remaining variance. Once again, Central Intactness and Family Constellation accounted for less than an additional 2% of the remaining variance. The prediction equation accounted for 57% of the variance and contained one significant value.

In general, the data revealed that the two best predictors of performance were Residual Hearing and Intellectual Factors. Residual Hearing was a particularly good predictor of oral skills as examined by the PLSE.

Comparison of the variables common to both the D-DMQ and the M-DMQ demonstrated that there was little difference between the two scales with the

Table 30

Summary of Cumulative Multiple Correlations and Raw Regression Coefficients for the PLSE Predicted by the D-DMQ

D-DMQ Variables (Predictors)	Multiple R	R^2	Regression Coefficient β	F Ratio
Residual Hearing	.59	.35	6.71	25.80**
Intellectual Factors	.67	.45	5.44	5.04*
Central Intactness	.68	.46	1.23	.55
Family Constellation	.68	.46	1.09	.04
Socioeconomic Situation	Could not be computed since all values were constant			

*p (1,36) < .05

**p (1,36) < .01

Table 31

Summary of Cumulative Multiple Correlations and Raw Regression Coefficients for the PLSE Predicted by the Common Variables on the M-DMQ

M-DMQ Variables (Predictors)	Multiple R	R^2	Regression Coefficient β	F Ratio
Residual Hearing	.70	.49	5.60	40.25**
Intellectual Factors	.75	.56	4.05	3.55
Central Intactness	.75	.57	1.30	.85
Family Constellation	.75	.57	.65	.18
Socioeconomic Situation	Could not be computed since all values were constant			

*p (1,36) < .05

**p (1,36) < .01

exception of the Residual Hearing variable. Thus, the different weights assigned to some of the M-DMQ variables such as Family Constellation and Socioeconomic Situation appear to have had no effect in terms of contributions to the overall predictive ability of the M-DMQ. However, the M-DMQ Residual Hearing factor consistently accounted for more of the overall variance than did its D-DMQ counterpart. It can therefore be concluded that the ability of the Residual Hearing variable to predict performance on linguistic and verbal tests is improved when other aspects of residual hearing, such as differences between the two ears and type and severity of the hearing loss, are taken into consideration.

It should be noted that the previously mentioned Kendall rank correlation analyses revealed significant correlations between both SAT's and Intellectual Factors and between Residual Hearing and the PLSE. The regression analyses indicated that these variables were also significant predictors of performance on the respective dependent measures and accounted for a large proportion of the variance. On the other hand, Kendall rank correlations between Central Intactness and both SAT's as well as between Family Constellation and the PLSE were significant, but these variables were not significant predictors of the same dependent measures as demonstrated by the regression analysis. However, the latter variables were entered later into the stepwise regression analysis and therefore had less residual variance to predict.

Multiple Regression Analysis II

A major concern of the present research was whether the inclusion of four additional variables increased the predictive value of the modified version of the D-DMQ. The SPSS subprogram Regression, using stepwise multiple regression, was applied to the independent variables in the correlation matrix.

The tables that follow are based on the entire M-DMQ which included the additional four variables.

Table 32 illustrates the results of the overall analysis of variance for the regression analysis for the nine independent variables on the M-DMQ.

Insert Table 32 about here

The results suggest that the independent variables as a whole were significant predictors of the dependent measures. However, overall significant results are merely a reflection of individual variables that were significant predictors of the performance measures. Therefore, the variables must be examined individually before any conclusions can be arrived at.

A stepwise multiple regression analysis was performed in order to determine the ability of the variables on the M-DMQ to predict performance on the dependent measures. The variables were entered into the regression equation according to the weights assigned to them by the M-DMQ, from highest to lowest. Thus, the variables were entered in the following order: Residual Hearing, Family Constellation, Central Intactness, Intellectual Factors, Linguistic Differences, Physical Handicaps, Amplification, Mode of Communication, and finally, Socioeconomic Situation. However, Socioeconomic Situation was not included in the analysis since the values were constant for all the subjects.

Tables 33, 34 and 35 present summaries of the regression analysis for the dependent measures and the nine variables of the complete M-DMQ. In Tables 33-35, the variables are listed according to the order in which they emerged from the computer arranged by the stepwise regression analysis.

Performance on the SATa as predicted by the nine dependent variables is presented in Table 33.

Table 32

Overall Regression Analysis for the Independent Variables

on the Complete M-DMQ

Dependent Variables	df	Mean Square	F
SATa	8 32	272.74 56.14	4.86**
SATb	8 32	193.95 67.63	2.87*
PLSE	8 32	54719.64 5974.28	9.16**

*$p < .05$

**$p < .01$

Insert Table 33 about here

Intellectual Factors was the only significant (at the .01 level) predictor of performance on the SATa. Residual Hearing, which was entered first in the stepwise multiple regression accounted for only 3% of the total variance. Mode of Communication accounted for 29% of the remaining variance, Intellectual Factors an additional 16%, and the remaining variables contributed an additional 10% to the remaining variance, for a total of 55%.

Performance on the SATb as predicted by the nine independent variables on the M-DMQ is presented in Table 34.

Insert Table 34 about here

Once again, Intellectual Factors was the only significant predictor (at the .05 level). Residual Hearing, entered first in the stepwise multiple regression analysis, accounted for 2% of the total variance. Intellectual Factors accounted for 23% of the remaining variance and Mode of Communication an additional 9%. The remaining variables contributed an additional 9% to the remaining variance for a total of 41%.

Performance on the PLSE as predicted by the nine independent variables on the M-DMQ is summarized in Table 35.

Insert Table 35 about here

Residual Hearing and Linguistic Differences were the only significant predictors of performance on the PLSE, the former at the .01 level of significance and the latter at the .05 level. Residual Hearing, entered first in the

Table 33

Summary of Cumulative Multiple Correlations and Raw Regression Coefficients for the SATa and the Complete M-DMQ

Independent Variables (Predictors)	Multiple R	R^2	Regression Coefficient β	F Ratio
Mode of Communication	.53	.29	.56	1.08
Intellectual Factors	.67	.45	.67	10.62**
Family Constellation	.69	.48	.21	1.92
Residual Hearing	.71	.51	.22	4.10
Amplification	.73	.53	.43	1.35
Central Intactness	.74	.55	.12	0.93
Linguistic Differences	.74	.55	.10	0.18
Physical Handicaps	.74	.55	.11	0.04
Socioeconomic Situation	Could not be computed since all values were constant			

*p (1,32) < .05
**p (1,32) < .01

Table 34

Summary of Cumulative Multiple Correlations and Raw Regression Coefficients for the SATb and the Complete M-DMQ

Independent Variables (Predictors)	Multiple R	R^2	Regression Coefficient β	F Ratio
Intellectual Factors	.48	.23	.55	5.89*
Mode of Communication	.57	.32	.36	0.36
Central Intactness	.60	.36	.23	2.96
Residual Hearing	.62	.38	.16	1.92
Family Constellation	.64	.41	.18	1.20
Amplification	.65	.42	.14	0.13
Linguistic Differences	.65	.42	.38	0.02
Physical Handicaps	.65	.42	.66	0.01
Socioeconomic Situation	Could not be computed since all values were constant			

*p (1,32) < .05

**p (1,32) < .01

Table 35

Summary of Cumulative Multiple Correlations and Raw Regression Coefficients for the PLSE and the Complete M-DMQ

Independent Variables (Predictors)	Multiple R	R^2	Regression Coefficient β	F Ratio
Residual Hearing	.70	.49	4.56	17.28**
Mode of Communication	.77	.59	6.31	1.27
Intellectual Factors	.79	.62	4.19	3.91
Linguistic Differences	.82	.66	5.93	5.84*
Central Intactness	.83	.68	1.31	1.06
Family Constellation	.83	.69	-1.26	0.68
Physical Handicaps	.83	.69	3.48	0.44
Amplification	.83	.70	-1.63	0.19
Socioeconomic Situation	Could not be computed since all values were constant			

*p (1,32) < .05

**p (1,32) < .01

stepwise multiple regression analysis, accounted for 49% of the total variance. Mode of Communication accounted for an additional 10% of the variance and the remaining variables accounted for an additional 10%, for a total of 69%.

In general, the regression analyses demonstrated that Intellectual Factors, Residual Hearing, Family Constellation and Linguistic Differences were the only significant predictors of performance on the dependent measures. Thus, the inclusion of components to a scale such as the DMQ other than Intellectual Factors, Residual Hearing, Linguistic Differences and Family Constellation adds minimal, if any, predictive value.

Additional conclusions which emerged from the M-DMQ regression analyses were the following: (a) D-DMQ and M-DMQ results were similar in that Residual Hearing was a significant predictor of performance on the speech test for both and Intellectual Factors was significant in predicting performance on the language tests: (b) the M-DMQ yielded fewer significant factors as a whole compared with the D-DMQ, and with the previous regression analysis illustrated in Tables 27, 29 and 31 where only the first five variables were taken into consideration, probably because the variance was spread over a greater number of variables; (c) Mode of Communication emerged as a visible, though not significant, variable accounting for a relatively large percentage of the remaining variance, especially in the case of the language tests; (d) of the four variables that were added to the original DMQ, Linguistic Differences turned out to be the only significant predictor, specifically with regard to the PLSE results; and (e) a greater percentage of the overall variance in each of the three dependent measures was accounted for by the predictors on the M-DMQ compared to those on the D-DMQ. Overall variance figures accounted for by the predictors on the D-DMQ were 48% for the SATa, 39% for the SATb and 57% for the PLSE as compared with 55% for the SATa, 41% for the SATb and 69%

for the PLSE on the M-DMQ. It should also be noted that the percentage of variance accounted for by the predictors, in the order of greatest to least, was on the phonetic speech test, followed by the SATa and then the SATb on both quotients.

It is interesting to note that the previously mentioned Kendall rank correlation analysis revealed significant correlations between both SAT's and Intellectual Factors as well as between Residual Hearing and the PLSE and Linguistic Differences and the PLSE. The regression analysis indicated that these variables were also significant predictors of performance on the respective dependent measures and accounted for a large proportion of the variance. In contrast, other Kendall rank correlations were significant, such as Mode of Communication and SATa, but the regression analysis demonstrated that they were not significant predictors of performance. However, it should be taken into consideration that the latter variables were entered later into the stepwise regression analysis and therefore had less residual variance to predict.

Validity of the Cutoff Criterion

The percentage of children who received a total DMQ score either above or below the cutoff point of 80 in the case of the D-DMQ or above and below the cutoff point of 100 on the M-DMQ, are presented in Table 36.

Insert Table 36 about here

Of the 90.9% students at the MOSD who passed the M-DMQ cutoff point which recommended that they receive an exclusively oral education, 20% were not considered orally successful by the school principal who was very familiar with all the subjects. "Orally successful" was defined as the

Table 36

Percentage of Children who Succeeded and who Failed to Reach the D-DMQ and M-DMQ Borderlines

DMQ	School: Mackay Center	School: MOSD
D-DMQ		
Passed[a]	10.5	41
Did Not Pass	89.5	59
M-DMQ		
Passed[b]	32	90.9
Did Not Pass	68	9.1

[a] A pass on the D-DMQ refers to a total DMQ score of greater than or equal to 80.

[b] A pass on the M-DMQ refers to a total DMQ score of greater than or equal to 100.

ability to communicate effectively via the auditory-oral mode exclusively. These subjects who were assigned to oral programs but whose oral skills were described as inadequate may be referred to as "false positives." No "false positives" from either school were identified by the D-DMQ since its cutoff point was so stringent.

Furthermore, 50% of the subjects at the Mackay Center who passed the M-DMQ cutoff criterion had originally attended oral schools for the hearing impaired. These children were considered oral school failures and were subsequently transferred to a total communication program. Thus, these students may also be designated as "false positives" since it is known retrospectively that they were not successful in an auditory-oral setting.

Hence, the problem with the M-DMQ criterion was that many subjects received total scores equal to or surpassing the cutoff criterion, recommending that they receive exclusively oral education, when in fact subjective judgments and past educational histories concerning their auditory-oral skills indicated otherwise.

On the other hand, 40% of the subjects from the MOSD who failed to pass the stringent D-DMQ criterion were nevertheless designated as orally successful by the MOSD principal. These children received D-DMQ scores which indicated that they should not be educated in an oral program. Hence, these subjects may be referred to as "false negatives."

In conclusion, it appears that the M-DMQ cutoff criterion was too lenient, resulting in many recommendations for oral school placement which were inappropriate. In contrast, the D-DMQ cutoff criterion seems to have been too stringent, by recommending that many successful auditory-oral candidates should be placed in a total communication educational environment. If these D-DMQ assignments had been real, 40% of the student sample who were effective oral communicators would have been assigned to total communication schools in which their oral potential would be unlikely to develop as fully as in an auditory-oral program. It is the author's opinion that even one student is too high a price to pay for the stringency of a scale such as the DMQ, let alone 40% of the student sample, but the trade-off between avoiding failure in an oral program and denying the opportunity for an oral education cannot be solved simply by shifting the cut off point. A more lenient criterion with careful follow-up evaluation may resolve the problem as will be suggested in a further section.

Conclusions

In addition to the general investigation into the construct validity of both DMQ scales, an attempt was made to answer the following questions:

(1) Which variables were the best predictors of reading comprehension and and phonetic speech skills?

(2) In the comparison of the D-DMQ with its modified version in terms of the five variables common to both scales, which quotient was more successful in predicting performance on the dependent measures?

(3) Was the predictive ability of the modified Residual Hearing variable improved?

(4) Which, if any, of the four new variables on the M-DMQ emerged as significant predictors? and

(5) What were the consequences of lowering the criterion on the M-DMQ?

In general, the following were the results that were obtained. In terms of the five variables common to both quotients, Intellectual Factors and Residual Hearing were the two best predictors of performance on the dependent measures. Intellectual Factors was the strongest significant predictor of performance on the reading comprehension tests and Residual Hearing was the strongest significant predictor of phonetic speech skills as evaluated by the PLSE. The only other significant variable was Family Constellation as a predictor of performance on the reading comprehension tests.

Comparison of the D-DMQ with its modified version indicated slight overall superiority of the M-DMQ in that a greater percentage of the overall variance was accounted for by the M-DMQ predictors than by those on the D-DMQ. In addition, the Pearson correlation analysis revealed that the M-DMQ total scores correlated somewhat better with the dependent measures than did the D-DMQ. However, if the two scales are compared in terms of individual predictors, few differences emerged other than the increased percentage of variance accounted for by the Residual Hearing variable on the M-DMQ. The different weights assigned to some of the variables on the M-DMQ appears to have had a minimal effect on increasing the predictive ability of the M-DMQ as a whole.

The Residual Hearing variable on the M-DMQ consistently accounted for more of the overall variance than did its D-DMQ counterpart, which appears to be a result of more thorough procedures of data collection for this variable on the M-DMQ.

Of the four new variables added to the M-DMQ, only the Linguistic Differences variable emerged as a significant predictor of performance on the phonetic speech evaluation.

Lowering the borderline on the M-DMQ resulted in an increased number of "false positives"; that is, subjects who were assigned to auditory-oral programs who had demonstrated in the past that they were unsuited for auditory-oral education. On the other hand, the borderline on the D-DMQ was found to be overly stringent since total communication educational placements were recommended for many children who had, in fact, achieved oral success. It may be preferable that a small number of "false positive" students be included in the assignment to auditory-oral programs, at least initially, rather than to exclude those children who have potential to become orally successful from obtaining an auditory-oral education.

Residual Hearing and the PLSE

The statistical analysis conducted by the present study demonstrated a significant correlation between the Residual Hearing variable and the Phonetic Level Speech Evaluation. In addition, Residual Hearing emerged as a significant predictor of performance on the PLSE, accounting for a large percentage of the variance. These results were even stronger for the Residual Hearing measurement on the M-DMQ for which additional data had been collected. It is interesting to note that previous studies of the relation between levels of hearing and Ling's PLSE demonstrated no significant findings. For example, a study by Ling and Shitrit (1980) found no significant correlation between the PLSE and the hearing levels of the subjects. Ling (personal communication, November, 1981b) interpreted the lack of significant findings as a result of too many confounding variables.

Construct Validity of the DMQ

In the present study, the construct validity of the DMQ was examined by investigating what proportion of the total variance was accounted for by the variables constituting the DMQ and its modified version. The proportion of total variance accounted for by the D-DMQ variables ranged from 39% on the SATb to 57% on the PLSE. The proportion of total variance accounted for by the M-DMQ ranged from 41% on the SATb to 69% on the PLSE. However, the overall variance accounted for by the variables is always a reflection of the percentage of variance contributed by the individual components (Kerlinger, 1964). Thus, the proportion of total variance accounted for by the predictors was relatively high only in the case of the PLSE which was a consequence of the Residual Hearing variable having predicted a significant portion of the total variance.

The analyses revealed that the only predictors consistently accounting for a significant portion of the variance on the DMQ were Intellectual Factors and Residual Hearing. Family Constellation emerged once as a significant predictor of one type of linguistic skill and Linguistic Differences on the M-DMQ was the only other significant predictor of performance on the PLSE. Therefore, it can be concluded that the construct validity of the DMQ as a whole, and that of its modified version, was limited, since so few of the other components of either quotient were significant predictors. Hence, the variables which were the significant predictors could be evaluated on an individual basis without incorporating them into a formal scale.

Many other variables which were related to linguistic and oral skills were not tested or were not appropriately measured in the present study; that is, some of the variables included on the quotients may have been important, but if the measurements used to obtain information for a specific variable were not the most appropriate, the variable would consequently emerge as a nonsignificant predictor. For example, in spite of the many claims in the literature attesting to the importance of parental support in terms of educating the hearing-impaired child, Family Constellation nevertheless did not emerge as a consistent significant predictor. In addition, significant negative correlations were obtained with Family Constellation and the PLSE scores. It is probable that the parental questionnaire measure used to obtain a rating for the Family Constellation variable was inadequate for the purpose of evaluating the emotional and educational supportiveness of the hearing-impaired child's parents. Therefore, the fact that the DMQ was shown to have limited construct validity is probably related to the manner in which the information was obtained for some of the variables.

The Predictive Scale Concept

The DMQ and its modified counterpart were shown to have limited construct validity based on retrospective data. Hence, the same problems arise in terms of using the quotients predictively to assign suitable educational programs to very young hearing-impaired children. Furthermore, additional problems arise when using scales such as the DMQ to predict educational placement. For example, Intellectual Factors was demonstrated to be a significant predictor of the dependent measures based on retrospective data. However, the measurement of intelligence or other intellectual qualities in babies or very young children (whether hearing-impaired or not) is currently not reliable and is prone to considerable error (Ling & Ling, 1978). In addition, parental support and ability are difficult to accurately quantify, particularly in the early stages when parents must deal with feelings of grief, anxiety and guilt. Use of a predictive scale at this time would, in many cases, produce invalid judgments about the parents' future capacities. Furthermore, the parents' motivation to acquire the knowledge and skills necessary to cope efficiently with their hearing-impaired child can be as much a measure of the teacher's or clinician's competencies as of parental capacity (Ling & Ling, 1978) and would also be difficult to measure.

Alternatives to the DMQ

Since it is currently not feasible to use a predictive scale based on tests which are neither valid nor reliable for the very young hearing-impaired child, an initial decision as to the type of early habilitation program will have to be made. As mentioned previously, Ling, Ling and Pflaster (1977) recommended the auditory-oral approach for all hearing-impaired children who were diagnosed at an early age. The essence of such a habilitation program is that progress of the hearing-impaired child is continually charted, monitored and reevaluated at regular intervals with adjustments made according to need. The major drawback of this approach is that some of the variables that should be regularly evaluated are difficult to quantify and many current assessment procedures are inadequate. However, the approach guarantees that every young hearing-impaired child is at least given the opportunity in the early stages to learn to communicate orally given the necessary auditory and visual support systems.

Ling (1981a) agreed that there are many factors that influence the linguistic and verbal progress of hearing-impaired children such as sensory, personal, social and environmental variables. However, he maintained that these factors can only be assessed in the course of training rather than to quantify these variables as predictive guidelines for educational placement. Ling pointed out that the variables which have to be regularly measured in the course of training are numerous, but may be classified under two headings: (1) dependent variables which measure the child's progress in the acquisition of oral skills, namely, speech reception, spoken language acquisition and speech production, and (2) independent variables intrinsic or extrinsic to the child which may influence his oral performance. Table 37 illustrates the intrinsic and extrinsic factors, some of which were arbitrarily assigned intrinsic or extrinsic status.

Insert Table 37 about here

Successful treatment involves considerably more interaction of variables than can be shown in simple diagrammatic form. The acquired abilities shown in the center box of Table 37 are the dependent variables which should be

Table 37

The Major Intrinsic and Extrinsic/Interactive Factors

Intrinsic	Acquired Abilities (Dependent Measures)	Extrinsic/Interactive
Hearing levels	Auditory skills	Hearing aids
Visual acuity	Visual skills	Glasses
Age at onset of hearing deficit	Auditory-visual skills	Socio-educational experience
Neurological status	Language comprehension	Environmental communication modes
Intelligence	Language expression	Parental collaboration
	Phonetic level speech skills	Teacher/clinician competence
	Phonologic level speech skills	Adjustment of child
	Academic attainments	Child behavior
		Child's contact with peers
		Child's cognitive functioning

Note. From Ling, 1981a, p. 324.

frequently measured to determine each child's level of skills, rate of progress and immediate learning requirements. Intrinsic variables include the child's cognitive development and sensory capabilities. Extrinsic variables include parental support, teacher competence, hearing aid maintenance and environmental features.

As a preliminary practical attempt to specify the critical variables and suggest various assessment instruments with which to evaluate them, Bernstein (1979) proposed a method of assessing the progress of hearing-impaired children in an auditory-oral habilitation program. She specified the assessment instruments and progress criteria for the dependent and independent variables that were outlined for approximately three years after the initiation of training. Flexibility of programming and regular assessment of the child's progress in all areas were intrinsic aspects of the program. Table 38 presents the dependent variables in the proposed auditory-oral habilitation program, the corresponding assessment instruments and approximate time limits commencing from initiation of training in which the skills should be attained.

Insert Table 38 about here

Tables 39 and 40 present some examples of independent (intrinsic and extrinsic) variables and their corresponding assessment instruments.

Insert Tables 39 and 40 about here

A child in an auditory-oral habilitation or parent-infant program would be expected to progress along the criteria specified for speech production, speech reception and spoken language acquisition. A child's failure to

Table 38

Criteria for Progress for the Dependent Variables and Corresponding Assessment Instruments

Dependent Variables	Criteria for Progress from Initiation of Training	Assessment Instruments
Speech reception		
- alertness to sound (detection)	Within 6 months	Schedules of development Five Sound Test
- attending to speech	Within 6 months	Auditory Discrimination Tests
- language comprehension	Within 6-12 months	Northcott Guide for Development
- speech discrimination and identification	Within 6-12 months	
Speech production		Ling's Phonetic Level Speech Evaluation
- supra segmentals		
- vowels		Ling's Phonologic Level Speech Evaluation
- consonants		
1st step 2nd step 3rd step blends	All to be completed within 3 to 4 years from beginning of program	

(continued)

Table 38 (Continued)

Dependent Variables	Criteria for Progress from Initiation of Training	Assessment Instruments
Spoken Language acquisition		
- vocalization	Within 3 months	Schedules of development
- production of syllabic babble	Within 6 months	Northcott Guide for Development
- use of word approximations	Within 6-12 months	Crystal Language Analysis
		Tyack and Gottsleben Language Analysis
- two word combinations	Within 2 years	Laura Lee Sentence Analysis (DSS & DST)
- sentences with subject and predicate	No later than 3 years	Peabody Picture Vocabulary Test
		Houston Test for Language Development
		Utah Test for Language Development
		Verbal Language Developmental Scale

Table 39

Criteria for Progress for the Independent Intrinsic Variables and Corresponding Assessment Instruments

Intrinsic Independent Variables	Criteria for Progress	Assessment Instruments
Age at onset		
-pre-lingual		
-post-lingual		
Age loss discovered		
Hearing level		Audiological assessment
Use of residual hearing		To be assessed by therapist in course of program
Physical status		
-sensory capabilities (e.g., vision)		
- handicaps		
Gross motor skills	Progress should follow normal development	Developmental assessment schema
Fine motor skills		Denver Developmental Screening Test
Perceptuo-cognitive development		Gesell Developmental Schedules
Neurological development		Bayley Scales of Infant Development

(continued)

Table 39 (continued)

Intrinsic Independent Variables	Criteria for Progress	Assessment Instruments
		Test for Gross Motor and Reflex Development
		Cognitive Skills Assessment Battery
		Boehm Test of Basic Concepts
		Northcott Guide and Developmental Patterns
Social-emotional development		Input from therapist and a team of consultants
Personal development		
Academic achievement		

Table 40

Some Independent Extrinsic Variables and Corresponding

Assessment Instruments

Independent Extrinsic Variables	Assessment Instruments
Hearing aids	
- appropriate fitting	Hearing aid evaluation
- maintenance and servicing	Electroacoustic measurements
- operation	
Parent - participation	To be assessed by therapist in
- aspirations	course of program
Environmental factors	
- home environment	
- availability of services	
Family	
- number of siblings	
- acceptance of hearing-impaired child by members of the family	
Teacher competence	
Appropriateness of program	To be assessed by therapist

progress at the appropriate rate would signal to the teacher that the related dependent and independent variables should be evaluated. For example, in the case of a child who did not respond to sound and did not vocalize after six months in the program, the following areas would be investigated: hearing aid function, suitability of the hearing aid fitting, evaluation of the child's development in all other areas, and parental involvement and skills. Upon finding that all the above conditions are adequate, the suitability of the program itself must then be evaluated. However, it would be unreasonable to transfer a child from an auditory-oral program directly into a total communication setting before considering the addition of visual or tactile modalities such as lipreading or cued speech according to the child's needs. (Cued speech is a visual cue system used to clarify the reception of lipreading [Ling & Ling, 1978]. Although every phoneme is cued, the hand movements from one sound to the next can be executed smoothly without affecting the rate or rhythm of what is said).

Although many of the assessment procedures corresponding to particular variables, such as evaluation of the teacher's competence, were not specified, Bernstein's proposal nevertheless is a preliminary practical approach related to Ling's (1981a) recommendations. Parent-infant programs of the type described by Bernstein were designed for all hearing-impaired children identified at an early age with the exception of certain individual cases such as a profoundly hearing-impaired child whose parents are also hearing-impaired and use sign language as their principal means of communication. In addition, Bernstein's approach is less feasible for the older hearing-impaired child who is not succeeding in an auditory-oral program, for the hearing-impaired child identified at a later age or for the child whose parents are unwilling or unable to participate in a parent-infant habilitation program such as the one described above. For these children, the concept of a predictive scale as the basis for an educational placement decision is preferable to the decision being made based on subjective biases on the part of the teachers or administrators involved. At the very least, the delineation of specific factors to be evaluated such as Ling's dependent and independent variables is recommended before an educational program is selected for any hearing-impaired child.

Suggestions for Future Research

The present study revealed that several of the variables incorporated in the D-DMQ and M-DMQ were inadequate measures due to the manner in which the information was obtained. Had the data been collected differently, certain variables may have otherwise appeared as significant predictors. For example, parental questionnaires should not be used as the single measure of parental support and capacities. They should be used in conjunction with other methods such as home visits and direct observations in addition to questionnaires administered to those having worked with the parents and the children in a professional context.

The Amplification variable could also have been improved by considering the age at which hearing aids were worn regularly and consistently rather than the age at which they were originally obtained. Many children may have received their hearing aids at an early age, but may not have worn or used them regularly for years afterward. In addition, granting full points for regular hearing aid usage at an earlier age than in the present study should also be considered.

In spite of the fact that the Residual Hearing variable emerged as a significant predictor, this variable nevertheless may have been improved by measuring the child's actual ability to use his residual hearing with hearing aids rather than to measure his hearing potential for pure tones without hearing aids. A child who is labeled as profoundly hearing-impaired on the basis of a threshold pure tone audiogram may easily function with superior hearing while wearing hearing aids (Sanders, 1976). The concern should be the child's functional hearing given the best amplification opportunities possible. If a measure of functional hearing is used, those children who make good use of their residual hearing in spite of profound hearing losses would not be discriminated against as they are when pure tone thresholds are measured.

The DMQ as a whole was too simplistic and failed to consider many variables that are related to linguistic performance. For example, intrinsic independent variables that should have been incorporated include personality characteristics of the child such as acceptance of criticism, social maturity and motivation to achieve. Independent extrinsic variables include teacher competence and teacher and administrator attitudes. The dependent variables in the present study should have included other variables such as the ability to paraphrase, to understand written directions, to use correct word order, and to vary sentence structure. Receptive aspects of linguistic competence, the production of suprasegmental features such as speech phrasing and appropriate stress patterns necessary for intelligible communication and the examination of written language skills should also have been considered. Reading comprehension and phonetic speech production should not serve as the only measures of the acquisition of linguistic skills, as they did in the present study.

If the present study is replicated, suggestions for future research also include the following recommendations.

(1) Hearing-impaired children who are totally integrated in regular schools should be included as subjects since they typify truly successful, orally educated hearing-impaired children and their lack of representation in the present study may have skewed the results.

(2) The predictive scale concept can be improved for the children who are unsuitable candidates for a parent-infant habilitation program by incorporating a borderline range in the scale of about 20-30 points rather than a specific borderline point beyond or below which the children succeed or fail. Thus, children whose total scores fall within the borderline range could be placed in an auditory oral program under special surveillance. If they encounter difficulty with linguistic or academic achievements, the addition of the visual or tactile modalities should be attempted within a specified time period before transfering the child to a total communication program. The solution to a child's lack of progress in an auditory-oral program is not necessarily the immediate transfer to a total communication setting. Many children who fail to succeed in oral programs also encounter difficulties in total communication settings. The factors which permit the children who fail in early oral programs to succeed in programs utilizing sign language are not yet known.

(3) Attention should also be paid to constructing and validating evaluation criteria of the dependent and independent variables related to linguistic and verbal skills. Further research is also required to specify the rates of progress which must be considered as too slow to justify the continuation of attempts to establish oral communication exclusively in early infancy.

<u>Summary</u>

In general, the results of the present study indicated that Intellectual Factors and Residual Hearing were the two best predictors of performance on the dependent measures. Intellectual Factors was the strongest significant predictor of performance on the reading comprehension tests and Residual Hearing was the strongest significant predictor of speech skills as evaluated by the PLSE. The only additional significant variable was Family Constellation as a predictor of performance on the reading comprehension tests. Slight overall superiority of the M-DMQ over the original DMQ scale was revealed, however, this was probably due to the increased predictability of the Residual Hearing variable on the M-DMQ. The different weights assigned to some of the variables on the M-DMQ appear to have had little effect. The changes incorporated in the Residual Hearing variable on the M-DMQ resulted in a greater proportion of the overall variance being accounted for by this variable than by its counterpart on the D-DMQ. Of the four variables added to the modified version of the DMQ, only Linguistic Differences emerged as a significant predictor of performance on the PLSE. The consequence of lowering the borderline on the M-DMQ was to increase the number of students who were inappropriately assigned to auditory-oral programs. A borderline range, as an alternative to a specific borderline point was recommended. It was concluded that the construct validity of the DMQ as a whole and that of its modified version was limited since so few of the variables on the quotients were significant predictors of performance on the dependent measures.

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APPENDIX A

PARENTAL QUESTIONNAIRE IN ENGLISH

Dear Parents:

We have included your child in a study conducted by McGill University which is investigating an important aspect of education for the hearing impaired.

We ask you to please fill out the enclosed questionnaire and send it back as soon as possible (a stamped, self-addressed envelope has been provided for this purpose). We stress the importance of sending back the filled-out questionnaire since your child cannot be included in our study if we have not received the questionnaire back from you.

Please respond to the questions as truthfully and thoughtfully as you can. We are relying upon your frankness and sincerity.

PLEASE DO NOT PUT YOUR NAME OR ADDRESS ON THE QUESTIONNAIRE. ALL INFORMATION WILL BE TREATED CONFIDENTIALLY AND WILL BE USED ONLY FOR PURPOSES OF SCIENTIFIC RESEARCH.

Thank you so much for your co-operation and assistance.

GENERAL INFORMATION

1. Sex: Male _______ Female _______ 2. Year of birth _______ 3. Year of Marriage _______

4. Living with spouse at present time. Yes _______ No _______

5. Married more than once. Yes _______ No _______

6. If married more than once, was previous marriage ended because of:
   Death _______ Divorce _______ Other (please state) _______

7. Draw a circle around the number of years of schooling you have completed.

12345678	1 2 3 4	1 2 3 4	1 2 3 4
Grade School	High School	College	Graduate Work

8. Husband's occupation (Be specific, such as Drug Store Clerk, College Professor, Automobile Mechanic, etc.) _______________

9. Wife's occupation _______________
   Full time _______ Part time _______

Note: In the following questions the child referred to is always your hearing impaired child.

10. Child's position in the family (1st born, 2nd, etc.) _______________

11. Child's birthdate _______________ Age _______________

12. Age of child when hearing loss occurred _______________ was diagnosed _______

13. How many physicians or specialists did you visit before hearing loss was identified? _______________

14. Degree of child's hearing loss: Profound _______ Severe _______ Moderate _______
    Mild _______ Average loss for speech frequencies (if known)
    Right ear _______ dB Left ear _______ dB
    Deaf _______ Hard of Hearing _______

15. To whom did you originally go when you suspected a hearing loss?
    Pediatrician _______ Otologist _______
    General Practitioner _______ Hearing Aid Dealer _______
    Audiologist _______ Speech & Hearing Center _______
    Friend or relative _______ Other _______

16. What diagnoses other than hearing loss were given; e.g., mental retardation, "slow development"? _______________
    By whom? _______________

17. Who gave the diagnosis of hearing impairment? _______________

*18 a. Have you ever sought professional counselling concerning your child's hearing problem? If yes, please describe.

____

____

____

____

*Questions added to Brown's (1971) Parent Attitude Questionnaire.

18 b. Are you or your child currently receiving the support of services concerning the social and emotional well-being of your child? If yes, please describe.

____
____
____
____

19. Are any members of Wife's family hearing impaired? (Do not include elderly relatives who lost hearing late in life.)
Yes _______ State relationship ____________________ No _______

20. Are any members of Husband's family hearing impaired?

Yes _______ State relationship ____________________ No _______

21. When you were a youngster did you know any hearing impaired children or adults?
Yes _______ No _______

22. During any part of your life have you known a hearing impaired person?
Yes _______ No _______

If yes, what was your relationship with this person? ______________

23. Prior to the discovery of your child's hearing loss had you ever seen a magazine or journal about hearing impaired children or adults? Yes _______
No _______
If Yes, give name(s) ______________________________________

24. Since learning of your child's impairment have you read any of the following?: (Please check those which you have read)

_______ American Annals of the Deaf
_______ Deaf American (Silent Worker)
_______ Exceptional Children
_______ Books Specify title(s) ______________________________
_______ Teacher of the Deaf
_______ Volta Review
_______ Other

*25. Do you subscribe to any of the above periodicals? Yes _______ No _______
If Yes, give name(s) and length of time during which you have subscribed.

____

*26. Please provide a rough estimate of the amount of time you spend with your child specifically working on his or her communication skills.

Never _______
Monthly _______
Weekly _______
Several times a week _______
Daily _______
Every couple of hours _______

*27. Could you describe the activities, games, strategies, etc., you use with your child while working on his or her communication skills.

____
____
____
____
____

NOTE: The following questions assume that your child is presently enrolled in a program for the hearing impaired.

28. At what age did your child begin his education as a hearing impaired child? ______

* Were you actively involved when your child began the hearing impaired program? If yes, could you please describe your involvement.

______

______

______

______

______

29. Have you ever visited a school or class for hearing impaired children other than the one in which your child is enrolled? Yes ______ No ______
If Yes, please give name(s) ______
Age level(s) of class(es) visited ______

30. How did you first hear about the program your child is attending?

______

______

31. Did anyone encourage you to send your child to his present school?
Yes ______ No ______ If Yes, state relationship of the person(s) ______

______

32. Have you visited your child's classroom? Yes ______ No ______ If Yes, approximately how many times? ______

*33. Are you currently attending classes which enable you to help with the education of your child? If yes, could you describe these classes.

______

______

______

*34. How often do you attend school meetings which concern your child?
Always ______
Most of the time ______
Sometimes ______
Rarely ______
Never ______

35. Has anyone suggested that you enroll your child in a program other than the one he is attending? Yes ______ No ______ If Yes, what was the relationship of that person to you and what type of program(s) did he (she) suggest? ______

______

______

36. Would you please rate the amount of confidence you have that you made the correct decision in placing your child in the program he is now attending:
______ Very confident
______ Fairly confident
______ Slight lack of confidence
______ Serious lack of confidence

*Could you state your reasons for having selected the particular rating you marked off?

____

____

____

37. Which of the following conditions do you feel is the most educationally handicapping for a young child? (Check one.)

_______ Deafness _______ Cerebral Palsy
_______ Blindness _______ Rheumatic Fever

38. What does the name Gallaudet mean to you? ______________________________

____

39. Are you a member of the Alexander Graham Bell Association for the Deaf?
Yes _______ No _______

40. Do you belong to any association of parents of deaf or hard of hearing children?
Yes _______ No _______ If yes, give name(s) ______________________________

____

41. Have you ever known a hearing impaired person who is a parent of hearing impaired or hearing children? Yes _______ No _______

*42. How do you usually communicate with your hearing impaired child?
Speech only _______
Speech with minimal use of gestures or signs _______
Some speech with many gestures or signs _______
Single words and phrases in speech, but mainly gestures or signs _______
Only gestures or signs _______

Should you have any questions about the questionnaire, we would be more than happy to answer them. Please call Joyce Svarc at
for any additional information you may require.

Your help in filling out this form has been greatly appreciated. Thank you so much.

APPENDIX B

PARENTAL QUESTIONNAIRE IN FRENCH

Chers Parents,

Nous avons retenu le nom de votre enfant pour une étude dirigée par l'Université McGill examinant un aspect important de l'éducation du déficient auditif.

Nous vous demandons de bien vouloir compléter le questionnaire ci-joint et de le rétourner dans le plus bref délai (une enveloppe de retour est incluse à cet effet). Il est essential de nous retourner le questionnaire dûment rempli puisque votre enfant ne pourra être considéré dans cette étude sans votre participation. S'il vous plaît répondre en toute sincérité avec le plus de précision possible. Nous vous faisons entièrement confiance.

Il est inutile d'indiquer votre nom et votre adrèsse sur ce feuillet-questionnaire. Ces renseignements sont confidentiels et ne seront utilisés qu'en fonction d'une recherche scientifique.

Nous vous sommes réconnaissants de votre participation ainsi què de votre collaboration.

INFORMATIONS D'ORDRE GENERAL

1. Sexe: Mâle _____ Femelle ______

2. Date de naissance ________________________

3. Année du marriage ________________________

4. Vivant avec conjoint présentement. Oui _____ Non _____

5. Marié plus d'une fois. Oui _____ Non _____

6. Si marié plus d'une fois cause:

   décès ______ divorcé ______ autre ______

7. Encercler le nombre d'années d'études complétées:

   1 2 3 4 5 6 7 8 1 2 3 4 1 2 3 4 1 2 3 4

   Niveau Elémentaire Sécondaire Collégial Universitaire

8. Êmploi du mari (Preciser, ex.: Mecanicien-automobile, commis dans une pharmacie, professeur dans un collège)

9. Occupation de l'épouse ____________________________________

   À temps plein ________________________ Temps partiel _______________

   N.B. Les questions suivantes concernent uniquement votre enfant souffrant de déficience auditive.

10. Rang de l'enfant dans la famille (Né le 1^{ier} 2e) etc. ____________

11. Date de naissance de l'enfant _____________________ Age ____________

12. Age de l'enfant: 1° au moment de l'apparition de la carence auditive __________

    2° quand le diagnostic fût posé _________________

13. Combien, de médecins ou spécialistes avez-vous consulté avant que le trouble auditif ne soit clairement dépisté?

14. Degré de la perte auditive: Profonde _________ Sévère _________

Moderée ________ Légère ________ Pourçentage de la perte par rapport à la fréquence du langage (si connu) Oreille droite ________ Oreille gauche _____ Sourd ______ Dur d'oreille ___

15. Qui avez-vous consulté en premier lieu quand vous avez découvert un trouble auditif chez votre enfant?

Pédiâtre ________________ Orthophoniste ________________

Médecin de famille ________ Marchand d'appareils auditifs ______

Audiologiste ____________ Clinique d'audiologie et

Ami ou connaissance ______ d'orthophonie ________________

16. Quel diagnostic outre la perte, auditive fût décrit; e.g., déficience mentale, développement lent, immaturité? ________________

Par qui? ________________________________

17. Qui a posé le diagnostic de déficience auditive? ____________

18a. Avez-vous déjà recouru à l'aide d'un conseiller professionnel concernant le problème auditif de votre enfant?

Si oui, s.v.p. elaborer ________________________________

____

____

____

18b. Recevez-vous ou votre enfant reçoit-il une aide spécifique concernant son développement social ou émotif? Si oui, détailler ____

____

____

____

19. Y-a-t-il des membres de la famille de l'épouse qui sont atteints de déficience auditive? (Ne pas inclure les plus âgés qui ont souffert

de surdité pendant leur vieillesse)

Oui ______ Lien de parenté ______ Non ______

20. Y-a-t-il des membres de la famille de l'époux qui souffrent de déficience auditive?

Oui ______ Lien de parente ______ Non ______

21. Quand vous étiez très jeune, avez-vous connu des gens (enfants ou adultes) souffrant de déficience auditive?

Oui ______ Non ______

22. Avez-vous déjà connu à quelque moment de votre vie une personne atteinte de déficience auditive?

Oui ______ Non ______

Si oui, quel a été votre lien avec cette personne?

23. Avant de savoir que votre enfant avait une carence auditive, aviez-vous déjà vu ou lû une revue ou journal traitant de troubles auditifs? Oui ______ Non ______

Si oui, donner le titre ______________________________

24. Depuis que vous connaissez la déficience de votre enfant, avez-vous déjà lû un de ces périodiques? (Cochez chacune des revues)

_____ American Annals of the Deaf _____ Teacher of the Deaf

_____ Deaf American (Silent Worker) _____ Volta Review

_____ Exceptional Children _____ Autre

Titre de livres: ______________________________

____

____

25. Souscrivez-vous à l'un des périodiques ci-haut mentionnés?

Oui ______ Non ______

Si oui, lequel et depuis combien de temps y êtes-vous abonné?

26. Pouvez-vous évaluer approximativement combien de temps vous consacrez au développement du langage de votre enfant.

Jamais ________ Plusieurs fois la semaine ________

Mensuellement ________ Quotidiennement ________

Hebdomadairement ________ Frequemment ________

27. Décrivez les activités, jeux, stratégies, etc., employés avec votre enfant en vue d'améliorer ses habilités linguistiques. ________

____

____

Remarque: Les questions suivantes supposent que votre enfant est présentement inscrit dans un programme destiné aux déficients auditifs.

28. A quel âge votre enfant a-t-il été inscrit dans un programme pour déficient auditif? ________

Etiez-vous impliqué de facon effective quand votre enfant a débuté dans ce programme? ________

Si oui, pourriez-vous décrire comment. ________

____

____

29. Avez-vous déjà visité une autre école ou classe pour déficients auditifs, mis à part celle de votre enfant? Oui ____ Non ____

Si oui, laquelle? Nom ________

Âge et degré des classes visitées. ________

30. Qui vous a informé initialement du programme dans lequel votre enfant est inscrit? ________

31. Quelqu'un vous a-t-il référé à l'école que votre enfant fréquente présentement? Oui ______ Non ______

Si oui, quel est votre lien avec cette personne? ____________________

____

32. Avez-vous déjà visité la classe de votre enfant? Oui ___ Non ___

Si oui, combien de fois approximativement? ____________________

33. Suiviez-vous présentement des cours en vue de contribuer à l'éducation de votre enfant? Si oui, de quelle nature sont ces cours?

____

____

34. Combien de fois assistez-vous aux réunions scolaires concernant votre enfant?

Toujours ____________________

La plupart du temps ____________________

Quelquefois ____________________

Rârement ____________________

Jamais ____________________

35. Quelqu'un vous a-t-il déjà suggéré un autre programme que celui dans lequel votre enfant est inscrit? Oui ______ Non ______

Si oui, quel est votre lien avec cette personne et quel genre de programme a-t-il (ou elle) suggéré? ____________________

____

36. Pouvez-vous mésurer combien vous êtes confiant dans votre décision d'inscrire votre enfant à son programme actuel:

______ Très confiant

______ Partiellement confiant

_______ Peu confiant

_______ Sérieusement indécis

Quelles sont les raisons qui ont prévalu dans votre indication ci-haut? ____

____

37. Quel est le handicap majeur de votre enfant façe à son éducation? (Cochez S.V.P.)

_______ Surdité   _______ Paralysie cérébrale

_______ Cécité   _______ Fièvre rhumathismale

____

38. À quoi le nom Gallaudet fait-il référence pour vous? ______________

____

39. Êtes-vous membre de l'Association Graham Bell pour les personnes souffrant de surdité? Oui _______ Non _______

40. Appartenez-vous à une association quelconque pour enfants sourds ou durs d'oreille? Oui _______ Non _______

Si oui, donnez-en le nom. ____

____

41. Avez-vous déjà rencontré un parent souffrant de déficience auditive ayant un ou plusieurs enfants avec une carence auditive?

Oui _______ Non _______

42. Comment communiquez-vous le plus souvent avec votre enfant qui est un déficient auditif?

Langage uniquement ____________________

Langage accompagné de gestes ______________

Gestes accompagnés de langage ______________

Quelques mots et phrases mais essentiellement par des gestes ______

Gestes et signes ________________

Si vous désirez avoir de plus amples informations où même si vous avez des questions au sujet du questionnaire, n'hésitez pas à communiquer avec Joyce Svarc à

Votre participation a ce sondage est hautement appreciee. Merci mille fois.

APPENDIX C

PARENTAL QUESTIONNAIRE IN HUNGARIAN

Note. Only relevant questions were included in the Hungarian questionnaire since the parents were reluctant to complete the lengthier version.

Tisztelt Mr. és Mrs.

Szeretnénk tudomására hozni, hogy leanyuk egyike azoknak a gyerekeknek akik ki lettek választva a McGill egyetemen tudomány kutatás czéljából a gyengén halló gyrekek érdekében.

Legyenek szivesek e tudományos czél érdekében a mellékelt kérdö ivet kitölteni és vissza küldeni sziveskédjék mielöbb. (Mellékelve küldünk egy bélyeggel és czimmel ellátott boritékot).

Sziveskedjék nevüket és czimüket kihagyni a kérdö-iven. Minden informáczio a legnagyobb discréczioval lessz kezelve és tisztán tudomány kutatás érdekében lesz felhasználva.

Ez a kérdö-iv csakis az Önnök részére lett Magyarra forditva, tudván hogy keszséges segitségük feltétlenül hasznos lessz a fent emlitett tudományos czélta.

1. Ki állapitotta meg legelöszor hallási nehézségeit? ________

____

2. Miután tudomásukra került leányuk hallási problémája, mikor és kit kerestek fel segitségül ezzel kapcsolatosan? ________________

____

3. Mi a helyzet jelenleg? Kap vagy Önnök irányitást vagy egyébb segitséget könnyebbitésre? Ha igen, sziveskedjek bövebben beszámolni.

____

____

4. Amióta tudomásukra jutott proplémája, olvastak e bármelyiket a következö könyvekböl: (kérem húzák alá, melyet olvastak).

_____ American Annals of the Deaf ___ Teacher of the Deaf

_____ Deaf American (Silent Worker) ___ Volta Review

_____ Exceptional Children ___ Other

_____ Egébb könyvek amit Önnök olvastak: sziveskedjek czimeket megemliteni.

5. Olvasnak esetleg ujság czikekket ezzel kapcsolatosan. Ha igen, irják meg mit?

6. Kérem jelöljék meg körül- belül mennyi idöt töltenek jelenleg értékezni tal? (Elösegiteni fejlödésében.)

Soha ______________ Néhányszor hetenként ______________

Havonta ______________ Naponta ______________

hetenként ______________ Minden másod órában ______________

7. Leirhatná a módot, gyakorlatot, társadalmi játékokat, stratégiat, vagy más módszert amit alkalmaznak értekezni leányukkal?

____

____

8. Részt vettek Önnök személyesen is amidön a gyerek elkezdte ezt a programot? (Könnyiteni hallási nehézségein), vagy csak maga? Ha Önnök is résztvettek, kérem irják meg milyen módon?

9. Latogatták e valaha egy osztalyt ahol más gyengén halló gyerekek vettek részt tanulásban, vagy csak azt ahová jár? Ha igen, irjak be az iskolat nevet es milyen korru gyerek voltak jelen?

10. Meglátogatták e valaha az iskolát ahova leanyok jár a hallása miatt; és ha igen, hányszor? (körül-belül)

11. Vesznek e Önnök is részt olyan elöadásokba, mely elösegiti gyermekük iskoláztatását? Ha igen, sziveskedjék leirni bövebben az elöadasokat.

12. Milyen gyakran vesznek részt iskolai gyüléseken mely a gyermekük sorsát érinti?

Mindég ______________

Legtöbbszor ______________

Valamikor ______________

Nagyon ritkán ______________

Soha ______________

13. Megvannak e gyözödve, hogy helyesen cselekedtek, midön leányukat beadtak a jelenlegi programba?

______ Teljesen meg vagyunk gyözödve

______ Valamennyire meg vagyunk gyözödve

_____ Kicsit kételkedünk

_____ Erösen ketelkedünk benne

14. A nev Gallaudet jelent valamit Önöknek? _______________

15. Tartoznak e valamilyen egyesülethez melyben a gyengén-halló gyerek szülei jövetkeznek? Igen _____ Nem _____ Ha igen, sziveskedjek az egyesület nevét megemliteni.

16. Högy értekeznek Önnök tal?

Csak beszéddel _______________

Beszéd és egy kevés gesztikulalassal _______________

Beszed és sok gesztikulassal _______________

Egyes szavák es frazisok, de foleg gesztikulallassal _______________

Csak gesztikulas es jelzesek segitsegevel _______________

Ha bár milyen kérdés felmerülne e kérdöjel kitöltése alatt, mi boldogan segitségükre lennénk. Nagyon kerjük hivják Joyce Svarc-ot a következö telephone szám alatt:

elérhetö, ha, bár milyen információra volna szükségük.

Halásan köszönjük Önnök fáradságát az iv kitöltésével kapcsolatosan.

APPENDIX D

PARENTAL QUESTIONNAIRE IN ITALIAN

Cari Genitori,

Abbiamo incluso vostro figlio in un corso di studi condotto dall'Università McGill; la quale sta investigando un importante espetto dell'educazione per i monomati di udito.

Vi pregriamo di voler completare l'annesso questionario e rispedircelo indietro al più presto possibile (una busta affrancata e indirizzata à provvista a questo scopo). Sottoliniamo l'importanza di spedirci indietro il completato questionario altrimenti vostro figlio non potrà essere incluso nel nostro corso di studi questore non riceviamo indietro il questionario.

Pregriamo di voler respondere alle domande con la massima sincerita e cautela possibile.

Non confidiamo sulla vostra franchezza e sincerita.

Non mettete il vostro nome o indirizzo sul questionario. Tutte le informazioni saranno trattate con discrezione e saranno usate solo a scopo di recerca scientifica.

Mille grazie per la vostra cooperazione ed assistenza.

INFORMAZIONE GENERALE

1. Sesso: Maschile ______ Femminile ______ 2. Anno di Nascita ______

3. Anno di Matrimonio ______

4. Dimorate col conivge presentamente. Si ______ No. ______

5. Sposato(a) più di una volta. Si. ______ No ______

6. Qualora sposato(a) più di una volta, fu il precedente matrimonio interrotto per causa di: Morte ______ Divorzio ______ Altro (specificare) ______

7. Circolate il numero di anni di scuola completati.

12345 ______	123 ______	12345 ______	12345 ______
Scuola Elementare	Scuolamedia	Scuola Secondaria	Università

8. Impiego del marito (specificare) impiegato d'ufficio, Professore Universitario, Meccanico, etc. ______

9. Impiego della moglie ______
Tempo Pieno ______ Tempo Parziale. ______

Nota: Nelle seguenti domande ci riferiamo solo al vostro bambino menomato di udito.

10. Posizione del bambino nella famiglia (1 nato, 2 nato, etc.) ______

11. Data di nascita del bambino ______ Età ______

12. Età del bambino quando perse l'udito ______ Fu diagonsticato ______

13. Quanti medici oppure specialisti avete visitato prima che la perdita dell'udito fu indentificata? ______

14. Grado di perdita dell'udito del bambino: Profonda ______ Severa ______
Moderata ______ Leggera ______ Media della perdita per discorso (se conosciuta)
Orecchio destro ______ DB ______ Orecchio Sinistro DB Sordo ______
Duro D'orecchi ______

15. A chi vi rivolgeste quando sospettaste una perdita di udito?

Pediatro ______	Otologo ______
Medico chirurgo ______	Venditore di Apparecchi acustici ______
Audiologisi ______	Centro della Parola e dell'udito ______
Amico o Parente ______	Altro ______

16. Quale altra diagnosi a parte della perdita di udito é stata data; esempio mentalmente ritardato, "lento sviluppo"? ______
Da chi ______

17. Chi ha dato la diagnosi di menomazione d'udito? ______

18 a. Avete chiesto consigli professionali, concermenti i problemi d'udito del vostro bambino?
Se si, descrivete____

18 b. Ricevete voi o et vostro bambino l'aiuto dei servizi concumenti il benessere sociale e emotino del vostro bambino? Se si descrivete?

19. Ci sono persone del lato materno con problemi d'udito? (non includete le persone che hanno perso l'udito in età avanzata)
Si ____________ Grado di parentela ____________ No ____________

20. Ci sono persone del lato paterno con problemi di udito?
Si ____________ Grado di parentela ____________ No ____________

21. Da giovane conosceste bambini o adulti menomati di udito? Si_____ No_________

22. Durante la vostra vita hai conosciuto una persona menomata di udito?
Si __________ No __________ Se si, quale era la parentela con questa persona?____________

23. Prima della scoperta della perdita di udito del vostro bambino avete letto una rivista o giornale riquardante i menomati di udito (bambini o adulti)
Si. ______ No ______ Se si, titolo della rèvista o giornale____________

24. Del momento della conosoenza della menomazione del vostro bambino avete letto una delle sequenti riviste? (contrassignate quelli che avete letti).
______American Annels of the Deaf
______Deaf American (Silent Worker)
______Exceptional Children
______Libri Specificare il titolo____________
______Teacher of the Deaf
______Volta Review
______Altro

25. Siete abbonato ad uno dei suddetti periodici? Si______ No______
Se si, titolo e durata dell'abbonamento.____________

26. Date una estimazione approssimata del tempo che dedicate al vostro bambino specificamente lavorando sulla sua abilita communicazione.
Mai_______ Meusilmente _______ Settimanalmente_______
Diversi volte alla settimana _______ Giornalmente _______ Ogni paio d'ore_______

27. Discrivete le attivita, giuochi, strategie, etc. che usate con il vostro bambino mentre ésercitate sua abilita di comunicazione.____________

NOTA: Le sequenti domande assumono che il vostro bambino è presentemente iscritto in un programma per menomati di udito.

28. A quale eta il vostro bambino comincio ad essere educato come menometo di udito? Foste voi attivamente coinvolti quando il vostro bambino comincio il programma per menomati di udito? Se si, descrivete il vostro convolgimento.________________

29. Avete visitato una scuola per bambini menemati di udito altre a quella frequentata dal vostro bambino? Si_______No_______ Se si date il nome della scuola__________ ______________________________Classi visitate______________________

30. Come siete venuto a conoscenza del programma che vostro figlio sta frequentando?

31. Siete stato incoraggieto da qualcunno per mandare vostro figlio alla presente scuola?________________
Si_______No_______ Se si, Grado di parentela con la persona________________

32. Avete visitato la classe del vostro bambino? Si_______No_______ Se si, quante volte approssimativamente? ________________

33. Frequentate corsi di abilitazione per aiutare l'educazione del vostro bambino? Se si, descrivete questi corsi ________________

34. Quante volte avete assistito a conferenze scolastiche concermenti il vostro bambino?

Sempre_______ Il piu delle volte_______
Qualche Volta_______ Raramente_______
Mai_______

35. Vi ha qualcuno suggirito di iscrivere vostro figlio in un altro programma? Si_______ No_______ Se si, quale è il grado di parentela con questa persona e quale tipo di programma vi ha suggerito?________________

36. Descrivete la fiducia che avete nell'aver fatto la giusta decisione nell'iscrivere vostro figlio al programma che sta frequentando:

_______Molto confidente _______Abbestenza confidente
_______Poca confidenza _______Mancanza di confidenza

Potete specificare le ragioni per aver scelto la velutazione che avete rimarcato?

____

____

____

37. Quali delle sequentti condizioni ritenete sia il più educativamente sventaggioso per il vostro bambino? (signate uno)
______Sordità ______Paralisi Cerebrale
______Cecità ______Febbre Reumatica

38. Cosa significa per voi il nome Gallaudet?______________________________
____

39. Siete voi membro dell'associazione per Sordi Alexander Graham Bell? Si______
No______

40. Siete voi membro di una qualsiasi associazionne di genitori di bambini sordi o duri di udito? Si______No______ Se si, nome dell'associazione______________
____

41. Avete conosciuto un menomato di udito, che sia genitore di un bambino menomato di audito? Si______No______

42. Come comunicate con il vostro bambino menomato di audito?
Solo Discorso________
Discorso con un minimo di gesti________
Siseorso con molti gesti________
Simpliei parole o frasi, una principalmente gesti________
Solo gesti o segni________

Per ulteriori informazioni circa questo questionerio, non esitate a chiamare Joyce Svarc al numero che sara ben lieta di aiutarvi.

La vostra assistenza nel completare questo modulo è stata molto stimata Grazie.

APPENDIX E

PARENTAL QUESTIONNAIRE IN SPANISH

Estimados Padres:

Hemos incluido su hijo/hija en un estudio conducido por la Universidad de McGill para investigar un aspecto importante de la educación de niños sordos o con deterioración auditiva.

Les pedimos que por favor completen este cuestionario y que lo manden devuelta lo antes posible (proveemos un sobre listo con estampillas y dirección). Ponémos énfasis que contesten todas las preguntas ya que su hijo/hija no podrá ser incluido en nuestra investigación si este cuestionario está incompleto.

Rogamos que contesten cuidadosamente y con la mayor veracidad. Confiamos en su franqueza y sinceridad.

No escriban ni su nombre ni su direccion sobre el cuestionario ya que las respuestas seran tratadas en forma confidencial y seran usadas unicamente con fines de investigacion cientifica.

Agradecemos su cooperación y su ayuda.

DATOS GENERALES

1. Sexo: Masulino ________
   Femenino ________
2. Año de Nacimiento: ________________
3. Año de Matrimonio: ________________
4. Vive actualmente con su esposo/esposa? Si ____ No ____
5. Casado/casada más de una vez? Si ____ No ____
6. Si se casó mas de una vez, fué a razón de: Divorcio ____________
   Muerte ____________
   Otra razón (diga cual) ____
7. Indique con un circulo cuantos años de esuela Ud. ha completado:

   1 2 3 4 5 6 7 8 — Escuela Primaria
   1 2 3 4 — Escuela Secundaria
   1 2 3 4 — Universidad
   1 2 3 4 — Doctorado

8. Ocupación del esposo (sea especifico, por ejemplo: empleado en una farmacia, profesor de universidad, mecánico de automoviles, etc.)

   ____

9. Ocupación de la esposa ______________________________

   Trabajo Permanente ________________

   Por hora ________________

   Nota: Todas las preguntas a continuación se refieren al niño sordo.

10. Posicion del niño en la familia (primer nacido, segundo, etc.) ____
11. Eu fecha de nacimiento: __________ Su edad actualmente: __________
12. Edad en la cual el niño (la niña) sufrió pérdida de audición: ______
    fué diagnosticado ______________
13. Cuantos médicos o especialistas vió antes que el problema auditivo fué identificado? ____________________

14. Grado de deterioración auditiva: Profundo ____________

Severo ____________

Moderado ____________

Leve ____________

Término medio de pérdida de frequencia de lenguaje (si Ud. sabe)

Oido derecho ____________ dB

Oido czquierdo ____________ dB

Sordo ____________

Deficultad para escuchar ________

15. A quién fué a ver cuando sospechó por primera vez que su hijo/hija tenia un problema auditivo?

Pediatra ____________ Especialista de oidos ____________

Doctor en Medicina General ___ Negocio de aparatos auditivos ______

Audiologista ____________ Clinica para sordos ____________

Amigo o Pariente ____________ Otro ____________

16. Les dieron otra diagnosis aparte de deterioración auditiva o sordera (por ejemplo: retardación mental, "desarollo lento," etc.). Por quien? ____________

17. Quién dió la diagnosis de deterioración auditiva o sordera? ____________

____

18a. Ha buscado Ud. alguna vez ayuda profesional con respecto al problema de audición de su hijo/hija?

Si ha buscado, dé algunos detalles por favor

____

____

____

18b. Actualmente, están Ud. o su hijo/hija recibiendo ayuda de servicios que se conciernen del bien estar social y emocional de su niño?

En el caso que si, por favor dé algunos detalles ______________________

____

____

____

19. Hay sordos entre los membros de la familia de la esposa? (no incluya parientes de edad que se pusieron sordos a causa de vejez):

Si ________ Cuál es el parentesco ______________

No ________

2[illegible]os entre los miembros de la familia del esposo?

[illegible] Cuál es el parentesco ______________

[illegible]

21. En su juventud, conoció Ud. a un niño o un adulto sordo? Si ______

No ______

22. Ha Ud. jamás conocido a una persona sorda? Si ______

No ______

En caso que si, cuál era su relación con ésa persona? ______________

____

23. Antes del descubrimiento de la deterioración auditiva de su hijo/hija habia Ud. visto una revista acerca éste tema? Si ____ No ____

En caso que si, de su(s) nombre(s) por favor ______________

24. Desde que se enteró que su hijo/hija es sordo/sorda, ha leído Ud. algunas de estas revistas? (Por favor indique las que ha leído)

American Annals of the Deaf ______________

Deaf American ______________

Exceptional Children ________________

Teacher of the Deaf ________________

Volta Review ________________

Libros ________________

Otras Revistas ________________

25. Se suscribe Ud. a cualquiera de las revistas nombradas en la pregunta # 24? Si ______ No ______

En caso que si, cuál revista, y por cuanto tiempo ha tenido la subscripción? ________________________________

____

26. Calcule por favor aproximadamente cuanto tiempo Ud. pasa con su hijo/hija tratando de desarollar sus habilidades de comunicación.

Nunca ________________

Mensualmente ________

Semanalmente ________

Varias veces por semana ________

Diariamente ________

Cada ciertas horas ______

27. Podría detallar las actividades, los juegos, etc., que Ud. usa con su hijo/hija al tratar de desarollar sus habilidades de comunicación.

____

____

____

Nota: Las preguntas siguientes son asumiendo que su hijo/hija está actualmente matriculado en un programa especial para niños sordos.

28. A qué edad empezó su hijo/hija una educación especial con relación a su problema auditivo? ______________________

Participó Ud. activamente cuando su hijo/hija empezó el programa?

En caso que si, podría dar algunos detalles acerca su participación?

____

____

____

29. Ha visitado Ud. alguna vez una escuela o una clase para niños sordos, aparte de la que su hijo/hija asiste? Si ______ No ______

En el caso que si, cuál? ______________

Que nivel de clase visitó? ______________

30. Como se enteró Ud. del programa en el cuál su hijo/hija esta actualmente matrículado/matriculada? ______________________

____

31. Alguien los animó que envien al niño a su esuela presente?

Si ________ Quien fué esa persona ______________

No ________

32. Ha visitado Ud. la sala de clase de su hijo/hija? Si ____ No ____

Aproximadamente cuantas veces ______________

33. Actualmente está Ud. asistiendo a clases que la capacitan para ayudar en la educación de su hijo/hija?

En el caso que si, podría dar algunos detalles sobre estas clases

____

____

____

____

34. Con que frequencia atiende Ud. reuniones escolares que conciernen a su hijo/hija?

Siempre ____________________

Casi siempre ____________________

De vez en cuando ____________

Raramente ____________________

Nunca ____________________

35. Le ha sugerido alguién que matricule a su hijo/hija en otro programa, aparte del cuál asiste ahora? Si ____ Quién se lo sugerió, y para que tipo de programa? ____

No ________

36. Podría por favor avaluar cuanta confianza tiene Ud. que ha tomado la decisión correcta al matricular a su hijo/hija en el programa al que asiste actualmente:

____ Mucha confianza

____ Cierta confianza

____ Cierta falta de confianza

____ Serias dudas y falta de confianza

Podría dar sus motivos par los cuales seleccionó su evaluación?

____

____

____

37. Segien Ud., cuál es la condición que pone más restricciones sobre la educación de un niño. (Indique uno)

Sordera ____________________

Ceguera ____________________

Parálises Cerebral ____________________

Fiebre reumática ____________________

38. El nombre Gallaudet, tiene algún significado para Ud.? ____________

____

39. Es Ud. miembro de la Asociación para Sordos Alexander Graham Bell?

Si ______ No ________

40. Pertenece Ud? a alguna asociación de padres de niños sordos o con dificultades auditivas? Si ______ No ____ Cuál? ____________

41. Ha conocido Ud. alguna vez una persona sorda que tiene hijos (con o sin problemas de audición). Si _____ No _____

42. Como se comunica Ud. habitualmente con si hijo/hija?

____ Con lenguaje solamente

____ Con lenguaje y pocos gestos

____ Con lenguaje y muchos gestos

____ Con algunas palabras y frases, pero principalmente con gestos

____ Con gestos y señales solamente

Si tiene cualquier pregunta concerniente a este cuestionario, le contestaremos con mucho gusto. Llame por favor a Joyce Svarc

si necesita información adicional.

Si habla solamente Español, puede llamar a

Con aprecio les agradecemos por haber sido tan amables en llenar este cuestionario.

APPENDIX F

PHONETIC LEVEL SPEECH EVALUATION

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LEAVES 194 – 199

Not Filmed

PHONETIC LEVEL SPEECH EVALUATION

BY Daniel Ling, PH.D. c 1967

Alexander Graham Bell
Association for the Deaf
WASHINGTON, D.C.

*to be used in conjunction with Speech for the Hearing -Impaired Child: Theory and Practice.