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An investigation of the value of auditory training in the education of deaf children

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AN INVESTIGATION OF THE VALUE OF AUDITORY TRAINING IN THE EDUCATION OF DEAF CHILDREN

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

For over a quarter of a century a difference of opinion has existed regarding the relative value of auditory training in the education of the deaf child. The opponents have insisted that in most deaf children there is little or no residual hearing on which to use acoustic stimulation. The proponents have insisted that there are extremely few deaf children who do not have some residual hearing which could be stimulated to promote better speech, to increase speech perception, and to advance better mental health.

I. THE PROBLEM

Statement of the problem. The purpose of this study has been (1) to investigate (a) the development of speech perception by the use of acoustic stimulation in schools for the deaf, and (b) the general tendency toward the use of the acoustic method in the schools for the deaf; and, (2) to determine whether or not auditory training has a definite place as an educational tool in the education of deaf children.

Importance of the study. Authorities in the field agree that lip reading is the most important tool in the education of the deaf. They feel that auditory training does not subtract any effectiveness from lip reading, but it does provide the natural channel for learning, that is, through the ear. The limited experiments show that profoundly deaf children do respond to acoustic stimulation if it is applied daily and systematically by a trained teacher over a period of time.

According to literature in the field, many psychological factors are present in hearing. Therefore, it is believed that auditory training has a definite effect on the child's mental development. It is felt that further investigation will reveal many factors relating to the use of auditory training as an educational tool in the Schools for the Deaf.

II. DEFINITIONS OF TERMS USED

The Committee on Nomenclature of the Conference of Executives of American Schools for the Deaf (1937), proposed the following classifications and definitions:

> The Deaf: Those in whom the sense of hearing is non-functional for the ordinary purposes of life. This general group is made up of two distinct classes based entirely on the time of the loss of hearing:

(a) The congentially deaf: Those who were born deaf.
(b) The adventitiously deaf: Those who were born with normal hearing but in whom the sense of hearing became non-functional later through illness or accident.[1]

Auditory training. Goldstein defines the acoustic method as:

> Stimulation of education of the hearing mechanism and its associated sense-organs by sound vibration as applied either by voice or any sonorous instrument.[2]

The writer uses the term auricular training interchangeably with auditory training.

Residual hearing. That hearing which may be present in an individual regardless of the defect of the auditory mechanism.

III. THE ORGANIZATION OF THE THESIS

The investigator will endeavor to show (1) the growth and development of auditory training, (2) the development of speech perception in deaf children by the

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[1] S. Richard Silverman, Hearing and Deafness, edited by Hallowell Davis (New York: Murray Hill Books, Inc., 1947), p. 353.

[2] Max A. Goldstein, The Acoustic Method (St. Louis: The Laryngoscope Press, 1939), p. 18.

use of auditory training in the educational program, as shown by test results, (3) the trend toward the more general use of auditory training as an educational tool as shown by statistics on educational data for private and public schools for the year 1939-1940, and, (4) the results of the questionnaire sent out by the investigator for 1951-1952.

CHAPTER II

THE HISTORY OF AUDITORY TRAINING

Introduction. As early as the first century, Archigenes, a Greek physician, advocated the use of a hearing trumpet and intensified sound in cases of defective audition. By means of exercises, Ernaud in 1761, was able to develop in pupils with residual hearing, the ability to differentiate various vocal sounds, and a hearing for words. Ernaud claimed that "total deafness did not exist."[1]

Itard, a French otologist, made the first substantial and scientifically logical experiment in the field of auditory stimulation in 1802. He observed that by frequently and regularly repeating vocal sounds into the ears of a group of congentially deaf children an increased hearing perception was being uniformly developed.

In 1805, Itard began his practice with bells, gradually reducing the tone intensity of this sound. Then he substituted musical tones, the rhythmic beat of the drums, the sustained notes of the flute, and, finally, the five elementary sustained vowels and the production of consonants.

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[1] Max A. Goldstein, The Acoustic Method (St. Louis: The Laryngoscope Press, 1939), p. 11.

For this experiment he used six deaf pupils. Three of these cases received daily practice for one year. His conclusions were as follows:

> In one case, where the sound of thunder and intense gongs were heard before the practice, word-hearing was developed; in the second case, where residual hearing for elementary sounds existed, word-hearing was developed; in the third case, whose residual hearing was far better than the first two cited cases, did not respond satisfactorily and as an end-result showed less progress than the other two.[2]

Interest in this method of education for the deaf seemed to wane for a period of years. But Goldstein reported that in 1884, Gallaudet devoted much time and thought to the idea of stimulating the residual hearing of the "semi-deaf."[3] Gallaudet was one of the leaders in the field for education for the deaf at the close of the nineteenth century.

Urbantschitsch. To Victor Urbantschitsch of Vienna belongs credit for the most profound and actual investigations in this field. He held daily practice with a group of pupils in Dobling State Institute for the Deaf in Vienna. The students were all given functional hearing

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[2] Ibid., p. 12.

[3] Ibid., p. 14.

tests and were classified as totally deaf. They responded negatively to tuning-fork tests both by aid and bone conduction, and were unable to distinguish sustained vowel sounds or any musical tones. After a year's consistent training of this group, Urbantschitsch, in 1893, gave his first public demonstration at the Medical Society of Vienna.

The results caused great consternation in the field of hearing, as,

> Urbantschitsch was challenged on every hand as to the total deafness of his pupils. Eighteen pupils were presented and the results shown indicated improvement varying from vowel differentiation to perception of complete sentences. In addition to practical demonstration, Urbantschitsch presented an analysis of his work and a plan by which such systemically conducted acoustic exercises could be carried on. It must be regarded as an index of unusual promise for oral education and acoustic work that so eminent an authority as Urbantschitsch, Professor Ordinarius in the University of Vienna and successor to the nestor and founder of modern otology, Adam Politzer, espoused this cause and took time and interest to make a careful and impartial scientific study of its merits and possibilities.[4]

Most authorities who had investigated and developed auditory perception by the acoustic method have worked with partially deaf children. Urbantschitsch was probably the first one who used profoundly deaf children.

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[4] Ibid., p. 15.

Max A. Goldstein. Goldstein was doing post-graduate work in Vienna and had the opportunity to observe Urbantschitsch daily. He was also present at his demonstration before the Vienna Medical Society.

Goldstein began further study into the Acoustic Method at Central Institute for the Deaf, St. Louis, Missouri, which he founded in 1914. He presented the Acoustic Method as a separate form of pedagogy.

He states that,

> . . . the progress made in acoustic engineering, sound amplification, teacher training, careful estimate of types and degrees of deafness, interpretation of audiograms and practical application of the successive steps of the Acoustic Method daily in the classroom, will insure satisfactory results.[5]

Goldstein planned his work at Central Institute in St. Louis to include every pupil, regardless of the degree of deafness, in the daily, systematic acoustic training program.

His definition of the Acoustic Method is comprehensive enough to include:

a. Voice and musical sounds directed through the physiological tract of the ear either to the peripheral or central auditory areas.
b. Sound vibration as sensed by tactile impression to interpret pitch, rhythm, accent, volume and inflection.

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[5] Ibid., p. 17.

c. Analysis of speech sounds by tactile differentiation.
d. Synthesis and speech construction by tactile impression.
e. Sound waves and their significance as appreciated by optical perception.[6]

Froeschel and Jellinek agree with Goldstein that if there is any residual hearing, however slight, the education of hearing is possible.[7] They maintain that in every case of deafness an attempt must be made to train that hearing.

In conjunction with this theory West remarks:

> . . . two fundamental principles should be observed: (1) The necessity of utilizing to the full the remnant of hearing that the patient possesses. (2) The need of developing other senses to take the place of hearing in the learning and control of speech.[8]

A. W. G. and Irene M. Ewing. During recent years the Ewings, leaders in the education of the deaf in England, have done much investigating and experimenting, to establish the value of auditory training as a means of educating deaf children. They state:

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[6] Ibid., p. 18.

[7] Emil Froeschel and Auguste Jellinek, Practice of Voice and Speech Therapy (Boston: The Expression Company, 1941), p. 111.

[8] Robert West, Lou Kennedy, and Anna Carr, The Rehabilitation of Speech (New York: Harper and Brothers, 1947), p. 256.

> The speech instinct acts as a starting point for using words, and hearing offers the stimulus to set it going and the way of learning to speak.[9]

They believe in combining lip reading and auditory training for the best results in educating the deaf child. Since the ear is the normal pathway for speech or sound to reach the brain, it is only sensible to keep this channel open and stimulated. A voice or any other sound arouses a natural response. Small deaf children begin to attempt speech when aural stimulation is provided. The Ewings assert that:

> The true value of oral education is not seen in the measure of success attained in speech; but that it can only be judged in the light of general intelligence and of behavior.[10]

They believe, in view of recent experiments, that only a very small number of children are totally deaf. Thus educators, not using acoustic stimulation in educating the deaf child, are missing a great opportunity for complete development of the child. Mrs. Ewing states that regular (daily) ear training is of permanent value in teaching a child to use his residual hearing to the maximum.[11] He is

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[9] Irene R. Ewing and A. W. G. Ewing, The Handicap of Deafness (London: Longmans, Green and Company, 1938), p. 204.

[10] Ibid., p. 250.

[11] Irene R. Ewing, Lip Reading and Hearing Aids (Manchester, England: Manchester University Press, 1946), p. 227.

more nearly a normal child because he is functioning through his five sense instead of through only four of them. When one of these sense is stimulated the others respond too, and there is greater mental activity.

The Ewings conclude,

> Lip reading must be thought of as the essential means of communication for these children, and hearing as the vital spark which sets aglow the words which are lip read and which give them fuller and more personal meaning. The sound of voice aids an emotional appeal to words which is missing, when lip read only and the voice is not heard.[12]

Summary. A summarization of current literature indicates that no child should be denied auditory stimulation, because he appears to have little or no residual hearing on which to work. In the education of a deaf child, when lip reading is combined with auditory stimulation the predominating effect is auditory. The child appears to "hear better" although no change has taken place in his auditory mechanism. The effect is psychological. The sound of a voice gives life to words.

For the adventitiously deaf, ear training is the means of retaining the memory of speech and sound. Our memory of sounds of pleasant occasions are part of our mental make-up and help us in keeping our mental poise.

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[12] Ewing and Ewing, op. cit., p. 225.

The sensation of sight, touch, movement, and hearing work together to develop and maintain habits of speech and voice control. Therefore, either group or individual auditory training brings to these children physical, mental, and social activity, thus promoting better mental health in the child.

It has been found that many children are classified as mentally retarded when their handicap is deafness. They seem to be slow in grasping ideas because of their hearing loss and limited experiences. Lane of Central Institute in St. Louis, in vigorous defense of the deaf child, states:

> Until 1930, psychologists who were pioneering in measuring the intelligence of the deaf reported a mental retardation of the deaf of from two to three years. The assumption was made that deafness and mental retardation were due to the same cause. Observations of the behavior of the deaf did not support this conclusion as a valid one.
>
> Careful examinations of the tests indicated that the tests used were not non-verbal in instructions; that experiences not possible for the deaf were included as tests items; and that in many schools, children were enrolled whose greatest affliction was mental retardation and not deafness.[13]

This chapter on the history of auditory training records a brief account of the growth and development of the

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[13] Helen Schick Lane, "Education of the Deaf Child," Twentieth Century Speech and Voice Correction, Emil Froeschels, editor (New York: Philosophical Library, 1948), p. 93.

acoustic method as a means of training the residual hearing of deaf children. As early as the first century the value of auditory stimulation was recognized and used with crude devices.

It is interesting to note that the otologists of the Middle Centuries were the first to recognize the value of auditory training. Educators of the deaf were somewhat skeptical as to its true value, therefore, its acceptance as a method to be used in the education of the deaf was somewhat slow.

Through the untiring efforts of Goldstein at Central Institute and the Ewings in England, the acoustic method has been accepted as a scientific means to be used in the education of the deaf.

CHAPTER III

TESTING FOR RESIDUAL HEARING

The purpose of this chapter is to present the various methods used in ascertaining the presence of residual hearing in the deaf child. It is felt that a knowledge of these methods will enrich the knowledge of the educators of deaf children and assist them in understanding the problems facing the children and themselves.

The writer does not go into detail as to the medical details of each test, but gives an over-all view of the testing program as used by modern otologists in deciding if residual hearing is present in a deaf child.

It is of interest to note that otologists and educators are working closely together to promote the welfare of the educational program of the deaf child.

Audiometric tests. One of the greatest problems is ascertaining whether any residual hearing exists. It often takes much time and daily practice to get even a slight response to acoustic stimulation from children who have never heard speech sounds or gross sounds, such as whistles, automobile horns, telephone bells, etc.

It is believed by many authorities that an audiometric test alone is not enough to establish either the

presence or absence of residual hearing. The audiometer furnishes ample proof in some cases, but it should not be taken as the final proof of profound deafness in all cases.

Motor reflex tests. Jellinek and Goldstein agree with the Ewings regarding the value of training residual hearing by the acoustic method. They also agree as to the value of motor reflex tests to establish the presence of residual hearing.

Jellinek asserts:

> In order to test a young child who does not speak yet and who does not react definitely to acoustic stimulations, the methods of audiometry and testing with tuning forks are inadequate. We test these children by observing their motor reflexes to sounds, and, if possible to react to sounds with spontaneous responses.
>
> Acoustic reflexes to sounds appear normally under the following conditions:
>
> 1. Minimal reflexes always occur in different organs but they can be put in evidence only by special apparatus.
> 2. Intense stimuli produce palpebral, pupillar and general muscular reflexes which may involve the whole body.
> 3. In special states of tonicity, acoustic reflexes are evident which otherwise are suppressed (for instance during sleep.)
> 4. Under increased irritability, they also may become more apparent.
> 5. Pathological conditions in the inner ear, especially in the labyrinth, often cause the appearance of acoustic reflexes.[1]

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[1] Auguste Jellinek, "Acoustic Education in Children," Twentieth Century Speech and Voice Correction, Emil Froeschels, editor (New York: Philosophical Library, 1948), p. 104.

The divisions of the labyrinth are classified physiologically as (a) acoustic labyrinth (cochlea), (b) the static labyrinth (the three semi-circular canals, and the uticle and saccule). Goldstein and other otologists have depended upon nystagmus (movement of the eyeballs) as an indication that the static labyrinth is not entirely inert, and if it is not some residual hearing is possibly present.

Nystagmus is made possible by the association of the vestibular nerve that controls the crista ampullaris, the motor nerves of the eye, and the pneumogastric (vagus) nerve. Such stimulation may be brought about by any of the following methods: (1) the rotation of the body in certain axes; (2) thermal reaction (douching with hot or cold water); (3) electric galvanic stimulation.

Goldstein reports:

> In cases of congenital deafness, we frequently find an audiogram that registers a hearing loss over 80 sensations units for two consecutive octave tone frequencies. In these cases, an active nystagmus may still be registered, indicating that the static labyrinth is still functioning. Assuming, therefore, that the acoustic labyrinth is not entirely inert, these pupils are still susceptible to sound stimulation by the Acoustic Method.[2]

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[2] Max A. Goldstein, The Accustic Method (St. Louis: The Laryngoscope Press, 1939), p. 147.

Even though many audiometrists contend that 100 db. loss at the 1024 d.v. tone frequency constitutes a total loss of serviceable hearing, Goldstein insists that:

> We are unable to recognize the arbitrary line of demarcation. We do not know where tactile sensation ends and where hearing sensation begins.[3]

The Ewings do not attempt a pure-tone audiometric test with children under four years of age.[4] They depend upon reflex and learned responses, such as the turning of the head or body to locate the sound. They use voice, percussion instruments, and pitch pipes.

It is often extremely difficult to ascertain which children can benefit from auditory training. Even though a child is slow to respond, he should be given daily practice over a long period of time, before he is labelled "totally deaf."

It is the opinion of Hardy and Pauls that:

> The damaged hearing mechanism is only part of the picture, in terms of language development and social maturity, the basic difficulty is that the child is unable to exchange ideas with others or to take his full part in the activities of the classroom, the playground, and the home.

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[3] Ibid., p. 148.

[4] Irene R. Ewing, "Deafness in Young Children" (Reprinted from Nutrition and Child Welfare Magazine, London: June, 1948), p. 7.

> We must center our attention on the psychological, social, and educational aspects of helping him to communicate with others. Not just his ears, but the child as a whole, is the focus of our attention.[5]

Summary. An attempt was made in this chapter to present the modern methods used by leading otologists in determining whether or not residual hearing is present. This is a most important factor in diagnosing the true condition of the hearing mechanism.

As has been shown, it is most unfair to the young deaf child to label him "totally deaf," when he has no conception of either speech or gross sounds. He cannot react when he does not know to what he is to react. But by stimulating the inner ear with its delicate nerve endings, we get a spontaneous response, not a learned response, and this is the truer picture of the child's auditory mechanism. It denotes that there is possibly a small amount of residual hearing, which with daily, systematic stimulation, may gradually respond to gross sounds and later on to the spoken word.

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[5] William G. Hardy and Miriam D. Pauls, "So That Children May Hear Better," (Reprinted from the Child's Magazine, September, 1950), p. 1.

When the educator is given a clear picture of the child's capabilities, he can plan his educational program accordingly. Thus, no time is wasted, and the child can receive from the beginning the benefits of all the modern acoustical equipment for auditory training.

CHAPTER IV

DESCRIPTION OF THE SUBJECTS, TESTS, PROCEDURES, AND RESULTS OF THE SPEECH PERCEPTION TESTS

Introduction. The specific purpose of this chapter is to submit the formal tests which have been given in the outstanding schools for the deaf in England and the United States. The purpose of these tests has been to try to ascertain to what degree hearing combined with lip reading assists the deaf child in speech perception.

The tests were given after a long period of daily, systematic auditory training. The tests are entirely different, but their validity lies in the fact that the same thing was being measured, and that the results show a definite increase of speech perception under entirely different conditions.

The writer constructed and presented an informal test to pupils of a class in a public school in California. This test is entirely different from any of the others, and yet it was intended to measure the gains, if any, which might be made in speech perception, after daily auditory training.

This chapter contains the description of the subjects, the tests presented, the procedures used, and the results

of these tests.

I. THE EWINGS IN ENGLAND

Introduction. Irene R. and A. W. G. Ewing, pioneers and leaders in the field of education for the deaf in England, have spent many years in research and experimentation. They have long advocated the training of residual hearing by acoustic stimulation. To obtain the best results, it is necessary to start the training as early as possible. They write:

> For the first time in history, powerful and reliable apparatus is available, by means of which 70 per cent of the children who are born deaf, or who acquire deafness during infancy, can be enabled to use their ears, although in many instances only to a very limited extent, in learning to talk.[1]

In 1938 they presented their experiment after many years of study. They endeavored to show that after a long period of acoustic stimulation combined with lip reading, the residual hearing had been trained to the point that it was useful in speech perception.

Description of the subjects used by the Ewings.

(Mary) Intelligibility tests given after training. Born severely deaf. All her speech has been taught. Intelligence above average. After 5 years teaching by

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[1] Irene R. Ewing and A. W. G. Ewing, The Handicap of Deafness (London: Longmans, Green and Company, 1938), p. 222.

oral methods with help of hearing aid apparatus, she is 2 years behind average hearing girls in reading ability, and 3 years in arithmetic.

Left ear:	128	256	512	1024	2048	4096
Db. loss:	90	75	80	95	110	110[2]

(Nancy) Education begun between 3½ and 4½ years of age. Intelligibility score given after 4½ years of teaching. Her achievement in English Composition at 8½ years is equal to that of 10 year old hearing girls in length of sentences. She spends much time in reading for pleasure, and enjoys books which are suitable for normal children of nine or ten.

Left ear:	128	256	512	1024	2048	4096
Db. loss:	70	70	75	85	85	80[3]

(John) Intelligibility tests given after training. Born severely deaf. Above average intelligence. Scarcely any speech or comprehension of it after some years attendance at normal schools. He was 9 years retarded when entering special class for the deaf. In 12 months education by oral methods with hearing-aid apparatus has advanced more than 1 year in reading and arithmetic.

Left ear:	128	256	512	1024	2048	4096
Db. loss:	40	50	70	90	85	85[4]

(Phyllis) Education began between 3½ and 4½ years of age. Speech now fluent and accurate. Intelligibility score after training. Born severely deaf. Scores highest in dictation (3 years below) where attention and perhaps visual memory count high. Arithmetic weak subject. Persevering temperment but learns slowly.

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[2] Ibid., p. 300.

[3] Loc. cit.

[4] Loc. cit.

Right ear:	128	256	512	1024		
Db. loss :	30	35	80	110[5]		

(Charles) Intelligibility tests after training. Born severely deaf. No speech until 4½ years. Intelligence, probably above average. His test scores are all above the highest available, i.e. for 14 year old hearing boys, except in mechanical arithmetic.

Left ear:	128	256	512	1024	2048	4096
Db. loss:	65	70	80	70	65	65[6]

Comment on audiograms. The Ewings have submitted the following audiograms to assist the reader in getting a true conception of the subject's hearing loss. (See audiograms on pages 24, 25, 26, 27, and 28.) The better ear was used in giving the test for unaided ear only. These children are profoundly deaf.

Description of tests. Tests of the Intelligibility of Speech were given by the Ewings.

> A series of tests was made with a number of severely deaf pupils. The object of the experiment was to compare the results of tests of the intelligibility of speech through (a) hearing, (b) lip reading, (c) unaided hearing and lip reading combined, and (d) aided hearing and lip reading combined.[7]

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[5] Ibid., p. 301.

[6] Loc. cit.

[7] Ibid., p. 225.

PATIENT'S NAME MARY OTHER RECORD

ADDRESS (Ewings' pupil) Right--better ear

CHARTED BY

DATE

xLeft Ear 0 Rt.Earx x Air

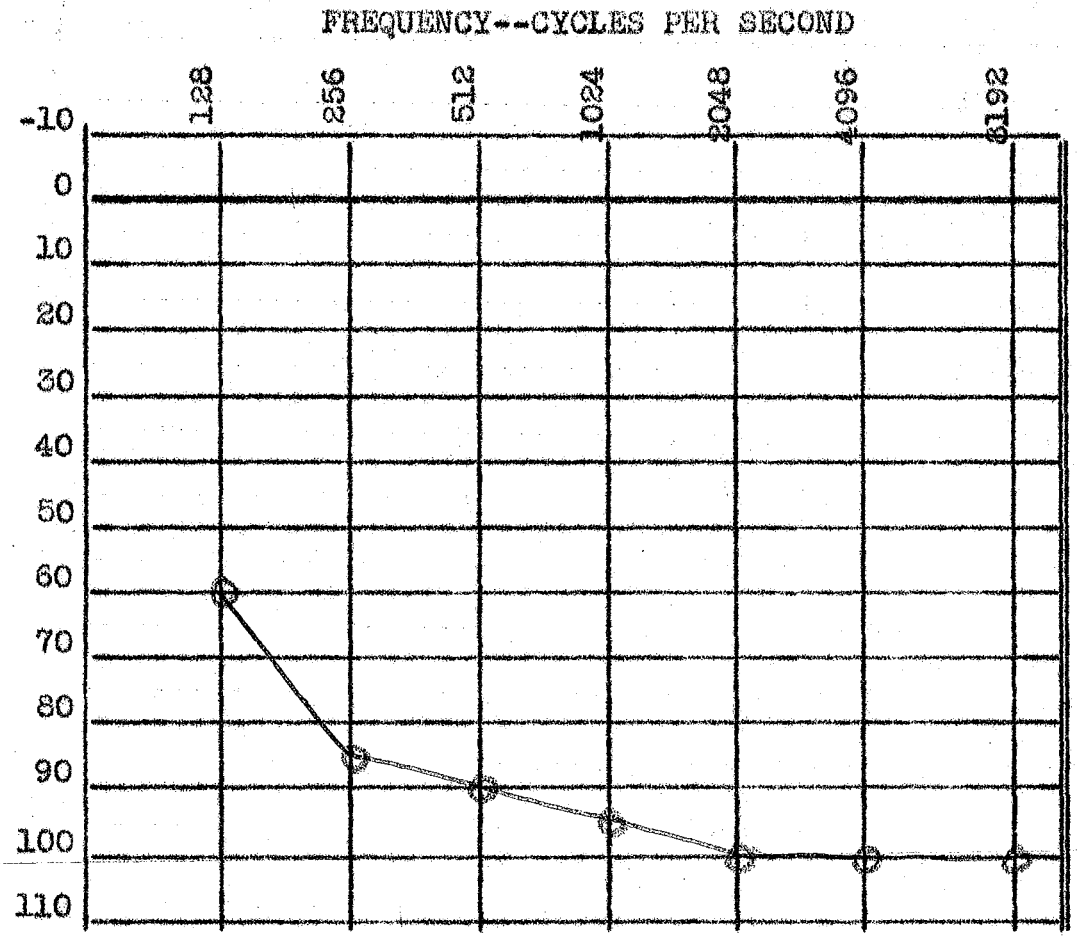

FIGURE 1

AUDIOGRAM

PATIENT'S NAME NANCY OTHER RECORD 8½ years

ADDRESS (Ewings' pupil) Right--better ear

CHARTED BY

DATE

xLeft Ear O Rt.Ear xAir

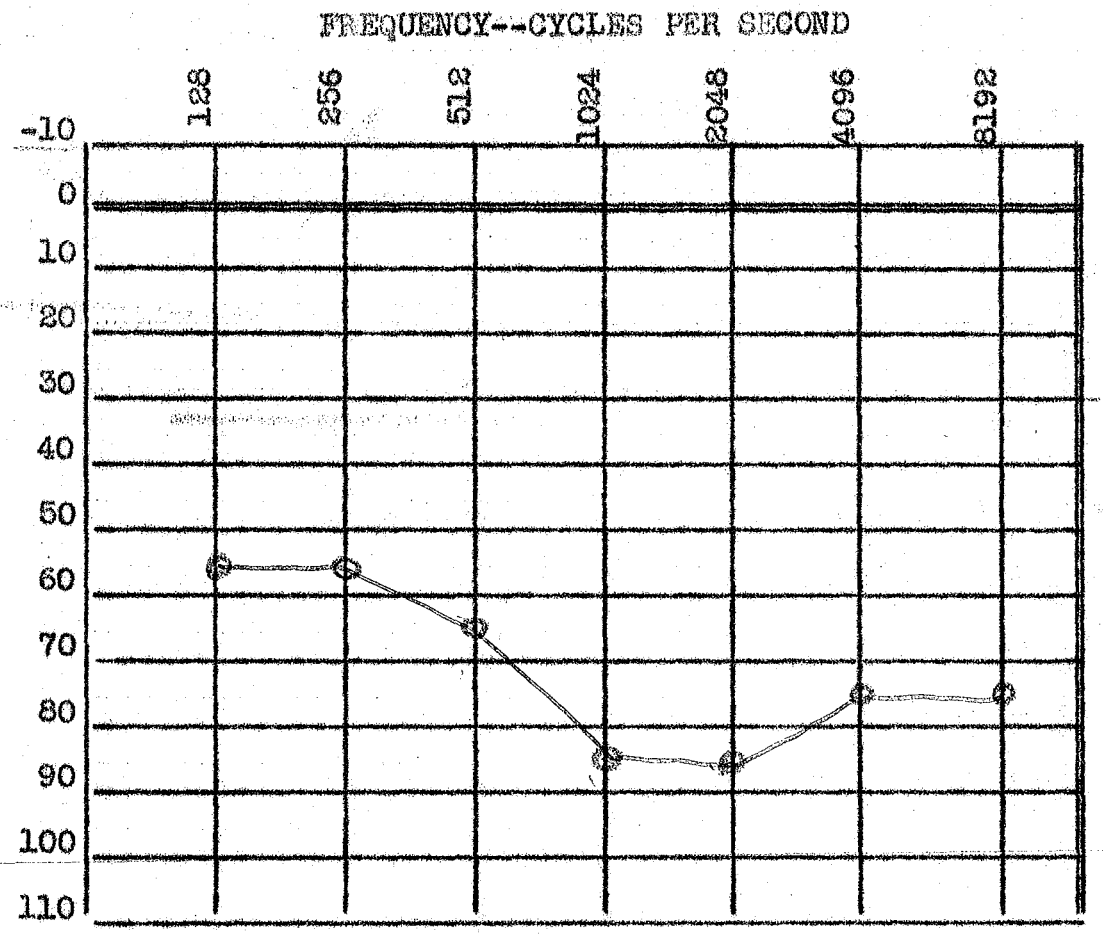

FIGURE 2

AUDIOGRAM

PATIENT'S NAME JOHN OTHER RECORD

ADDRESS (Ewings' pupil) Right--better ear

CHARTED BY

DATE

xLeft Ear 0 Rt. Ear x x Air

FREQUENCY--CYCLES PER SECOND

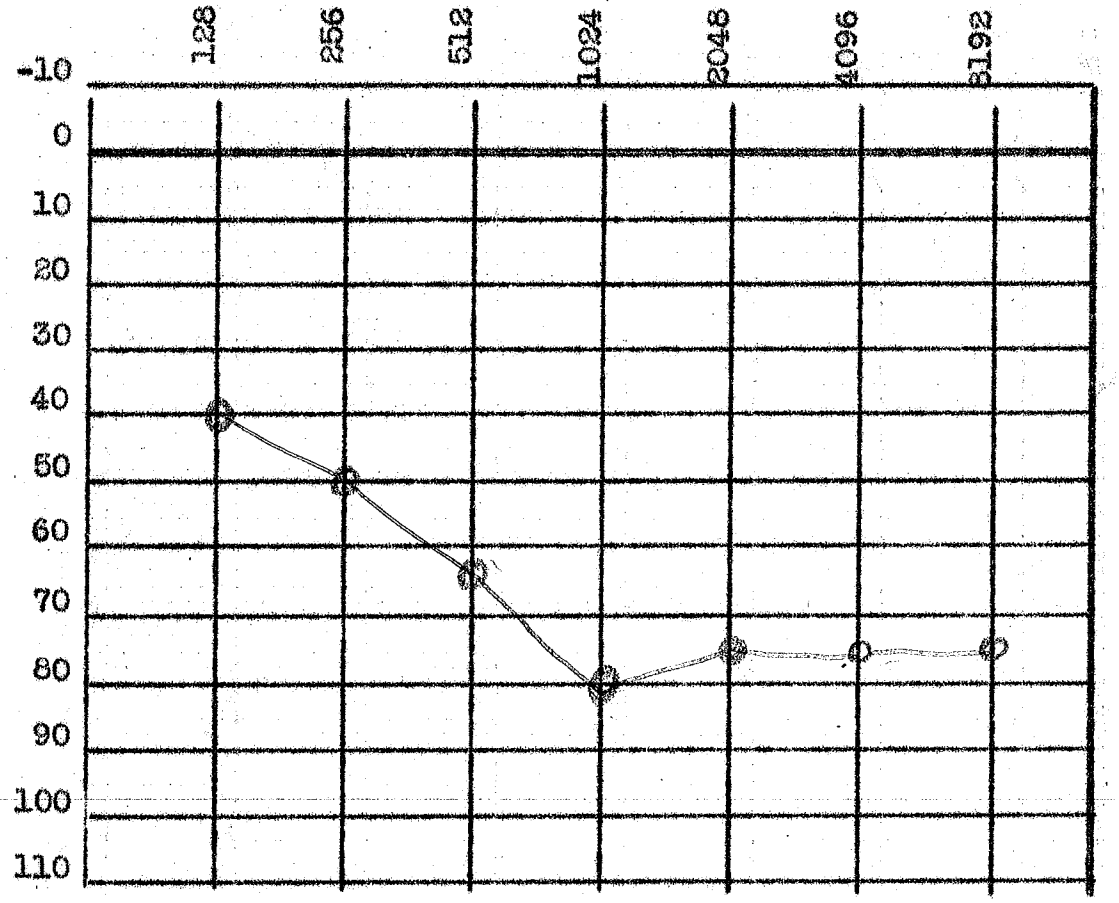

FIGURE 3

AUDIOGRAM

PATIENT'S NAME PHYLLIS OTHER RECORD

ADDRESS (Ewings' pupil) Left--better ear

CHARTED BY

DATE

xLeft ear x O Rt.Ear xAir

FREQUENCY--CYCLES PER SECOND

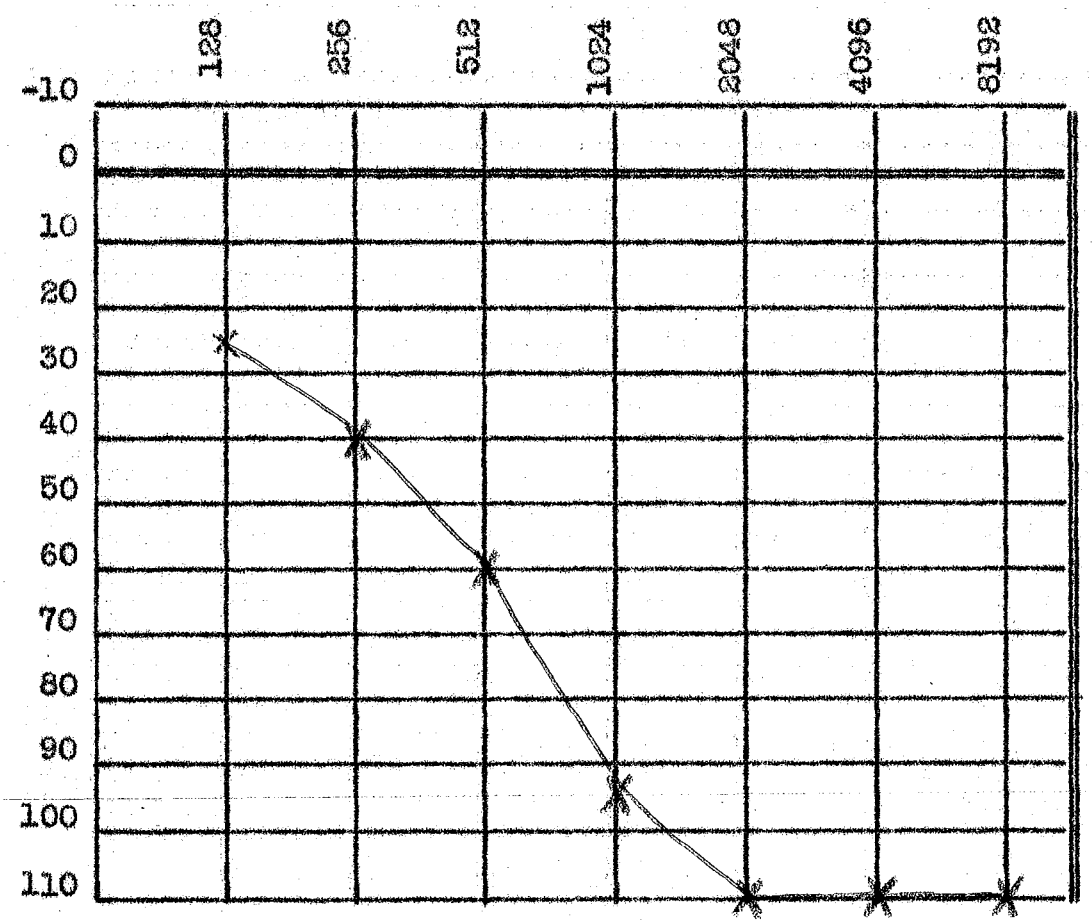

FIGURE 4

AUDIOGRAM

PATIENT'S NAME CHARLES OTHER RECORD

ADDRESS (Ewings' pupil) Right--better ear

CHARTED BY

DATE

xLeft Ear O Rt.Ear x x Air

FREQUENCY--CYCLES PER SECOND

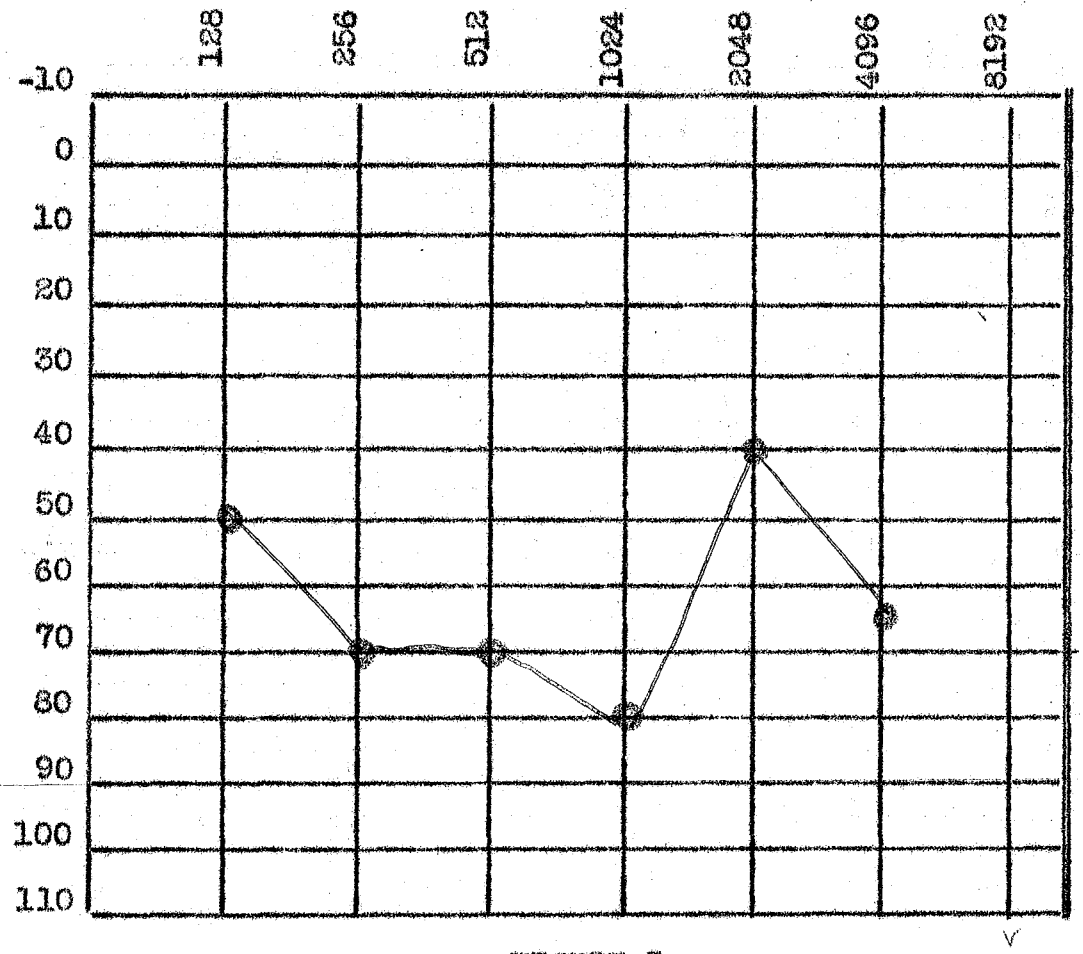

FIGURE 5

AUDIOGRAM

The tests[8] have been found effective for estimating the following points:

a. The relative ability of different deaf listeners to hear and recognize vowel and consonant sounds,
b. The extent to which an individual deaf patient or pupil is helped by a particular hearing-aid; and,
c. The efficiency of a hearing-aid when used by the same person on different occasions.[9]

Procedure. The examiner strikes out vowel incorrectly heard, in the vowel test. In the consonant test, the examiner strikes out syllables of which consonant is incorrectly heard. One or more columns may be used at each test.

Results of the Ewings' tests. As indicated in Table I, page 32, a comparison of column A (unaided hearing only) and column C (with hearing-aid only), the gains were outstanding. The subjects with "no names" showed no histories or audiograms.

The Ewings endeavored to show that by training the residual hearing of severely deaf children, with daily, systematic acoustic stimulation, it can be made useful for speech perception.

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[8] See tests on pages 30 and 31.

[9] Ewing and Ewing, op. cit., pp. 319-323.

THE VOWEL TEST

(The Ewings')

A	B	C	D	
ah	aw	le	ay	oo
er	ee	ay	oo	ah
ay	ow	oo	ah	aw
ow	ay	ay	ee	oa
oy	oo	oa	er	ie
oo	ie	er	oa	ay
aw	oa	ow	ow	ow
oa	er	aw	oy	er
ee	ah	oy	aw	ee
ie	oy	ee	ie	oy

Index letter:

A--unaided ear only

B--hearing-aid only

C--hearing-aid and lip reading combined

D--lip reading only

THE CONSONANT TEST

(The Ewings')

A	B	C	D	
baw	daw	shaw	law	saw
vaw	saw	baw	gaw	thaw
gaw	vaw	maw	saw	maw
law	shaw	law	daw	shaw
shaw	jaw	vaw	baw	daw
maw	maw	gaw	jaw	baw
jaw	law	daw	maw	jaw
daw	gaw	saw	vaw	gaw
saw	thaw	jaw	thaw	law
thaw	baw	thaw	shaw	vaw

Index letter:

A--unaided ear only

B--hearing-aid only

C--hearing-aid and lip reading combined

D--lip reading only

TABLE I

RESULT OF EWINGS' EXPERIMENT[10]

Pupils	A Unaided hearing only		B Unaided hearing and lip reading		C With aid, without lip reading		With aid and lip reading	
	vowels	consonants	vowels	consonants	vowels	consonants	vowels	consonants
Mary	0	0	73	50	27	11	82	67
Nancy	0	0	no test		95	50	95	86
John	0	0	85	41	91	66	100	74
Phyllis	24	7	81	66	76	46	94	86
no name	54	21	82	52	98	95	97	97
Charles	48	23	100	65	100	91	100	98
no name	76	25	91	73	82	50	97	84

[10] Ibid., p. 226.

The above figures represent the percentage heard correctly.

TABLE II

COMPARISON OF GAINS MADE AFTER AUDITORY TRAINING

	A Unaided hearing only %		C With hearing aid only %		Gains in Perception %	Gains in Perception %
Pupils	vowels	consonants	vowels	consonants	vowels	consonants
Mary	0	0	27	11	27	11
Nancy	0	0	95	50	95	50
John	0	0	91	66	91	66
Phyllis	24	7	76	46	52	39
No name	54	21	98	95	44	74
Charles	48	23	100	91	52	68
No name	76	25	82	50	6	25
Average percentage gains					52.42%	47.57%

By comparing column B (lip reading only) and column D (combining lip reading and hearing aid), a noticeable increase in speech perception was indicated.[11] The increases in the scores were not as great as those in column A and C. This may be due to the fact that these children were probably skilled in lip reading, and the hearing aid was secondary as a means of speech perception. But since there is a definite increase, the value of acoustic stimulation was taken into consideration and acknowledged by the Ewings as a means of assisting the severely deaf child in speech perception.

It is of interest that the average percentage gain for the vowels was 31.04 per cent, while for the consonants, the average percentage gain was 37.03 per cent. With normal listeners it has been found by the Bell Telephone Laboratories that only 30 per cent of the vowels and consonants need to be heard to give a 90 per cent score on sentences.

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[11] See Table III, p. 35.

TABLE III

COMPARISON OF GAINS MADE BY COMBINING LIP READING AND HEARING (EWINGS' EXPERIMENT)

	B Unaided hearing and lip reading %		D With aid and lip reading %		Gains in Perception %	Gains in Perception %
Pupils	vowels	consonants	vowels	consonants	vowels	consonants
Mary	73	50	82	67	9	17
Nancy	no test		95	86		
John	85	41	100	74	15	33
Phyllis	81	66	94	86	13	20
No name	82	52	97	97	15	45
Charles	100	65	100	98	0	33
No name	91	73	97	84	6	11
Average percentage gains					9.66%	26.5%

II. THE CLARKE SCHOOL'S EXPERIMENT

Introduction. For the past three years, the Clarke School for the Deaf at Northampton, Massachusetts, has devoted considerable time to experimental phonetics. Hudgins, head of the Experimental Phonetics Division, at the Clarke School, has spent a great portion of his time in supervising the acoustic training project sponsored by the Committee on Hearing of the National Research Council.[12]

In this Acoustic Training Experiment, not only was speech perception and speech intelligibility tested, but the Stanford Achievement Tests were used to measure Educational Achievement. In this manner, the entire educational progress of the children was measured. Tests were made at the beginning of the year and at the end of the year.

Hudgins states:

> A new experimental group, x-3, was started on the specially designed hearing aid in the Fall of 1950. This group is composed of a class of eight profoundly deaf pupils of the third grade level. . . . This group spent the entire school day in the specially equipped room where they were taught by the regular teaching staff of the middle school.

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[12] Clarence Hudgins, Eighty-fourth Annual Report, 1950-51 (Clarke School for the Deaf, Northampton, Massachusetts, 1951), p. 35.

> As a control group for the x-3 class, there is available test data obtained from a similar group of seven pupils tested during their second year in the middle school during the year 1948-49. The routine for the control group, C2, differed from that of the experimental group primarily in that the class rotated from room to room and used such hearing loss of the experimental group as shown in Table I /shown as Tables Iv and V in this thesis/ is considerably greater than that of the control group. Achievement test scores for the control group indicated that they were slightly in advance of the experimental group.[13]

Description of tests used at the Clarke School. Hudgins used three types of tests to measure achievement in Speech Perception.[14] For lip reading progress, he used two tests: (a) monosyllabic word lists (PBF), and (b) the Heider Lip Reading Film, which consists of short sentences. For auditory discrimination for speech, he used word lists. (See Hearing Only in Table VI, page 40.) To ascertain the effect of hearing as an aid to lip reading, he used the PBF lists. (See Look and Listen in Table VI, page 40.)

Results of the Clarke School Experiment. In conclusion Hudgins remarks:

> It should be noted that the differences between lip reading scores (words) and the 'Look and Listen' scores indicate the degree to which hearing is assisting vision in speech perception.[15]

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[13] Loc. cit.

[14] Hudgins, op. cit., p. 36.

[15] Loc. cit.

TABLE IV

DESCRIPTION OF SUBJECTS
(CLARKE SCHOOL)[16]

		EXPERIMENTAL CLASS	
Pupil	Age*	Hearing Loss Left ear*	Hearing Loss Right ear*
R.A.	8-9	75 db.	117 db.
R.B.	9-7	85 db.	83 db.
K.B.	8-7	112 db.	98 db.
S.B.	10-1	98 db.	102 db.
P.H.	10-2	92 db.	90 db.
R.K.	8-9	110 db.	110 db.
A. McA.	9-8	104 db.	105 db.
R. McE.	10-2	102 db.	97 db.
Averages	9-6	98 db.	100 db.

* Ages and average hearing losses (in the speech range) at the beginning of the experimental period.

[16] Loc. cit.

TABLE V

DESCRIPTION OF SUBJECTS
(CLARKE SCHOOL)[17]

	CONTROL CLASS		
Pupil	Age*	Hearing Loss Left ear*	Hearing Loss Right ear*
C.C.	10-3	82 db.	83 db.
C.H.	10-1	60 db.	62 db.
M.M.	12-1	68 db.	68 db.
H.S.	9-10	88 db.	92 db.
W.T.	10-9	93 db.	95 db.
R.T.	10-1	83 db.	87 db.
C.W.	9-2	98 db.	95 db.
Avereges	10-4	80 db.	79 db.

* Ages and average hearing losses (in the speech range) at the beginning of the experimental period.

[17] Loc. cit.

TABLE VI

GAINS MADE IN SPEECH PERCEPTION AFTER AUDITORY TRAINING
RESULTS OF CLARKE SCHOOL EXPERIMENT

Tests	Initial		Final		Gains	
	X-3*	C-2**	X-3	C-2	X-3	C-2
Lip reading, words	24%	34%	37%	46%	13%	12%
Lip reading, film	17%	59%	29%	56%	12%	-3%
PBF lists Look and Listen	32%	39%	44%	54%	12%	15%
Word lists, Hearing only	10%	16%	11%	13%	1%	-3%

* X-3--Experimental Group

** C-2--Control Group

The above figures are the average percentage scores for each class in their initial and final tests.

It is of vital importance to note that both the Ewings and Hudgins are interested in ascertaining to what degree lip reading and hearing combined is assisting in promoting better speech perception, in the deaf child.

Table VI, page 40, shows the percentage gains made in speech perception by both the experimental and control groups.

Summary of Clarke School Experiment. As shown in Table VI, page 40, the two classes made equal gains in lip reading, but on the film test the experimental class made outstanding gains. Hudgins believed that the gains made under "Look and Listen" which is lip reading and hearing combined, was the result of acoustic training. It is shown that neither group made any progress in "Hearing only."

The progress made in speech intelligibility by the experimental group is very slight. The control group shows a somewhat greater gain. Apparently the effects of the acoustic training are not reflected in the speech intelligibility of the experimental group. Hudgins says:

> . . . we may assume that foundations for general speech improvement are being established which, while not apparent at the end of the first year, may be expected to appear in subsequent tests.[18]

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[18] Ibid., p. 37.

TABLE VII

GAINS MADE IN SPEECH INTELLIGIBILITY
AFTER AUDITORY TRAINING
RESULTS OF CLARKE SCHOOL EXPERIMENT

Tests	Initial		Final		Gains	
	X-3*	C-2**	X-3	C-2	X-3	C-2
PBF words	35%	33%	39%	46%	4%	13%
Sentences	51%	67%	41%	86%	-3%	19%

* X-3--Experimental Group

** C-2--Control Group

TABLE VIII

GAINS MADE IN EDUCATIONAL ACHIEVEMENT
RESULTS OF CLARKE SCHOOL EXPERIMENT

	Initial		Final		Gains	
	X-3*	C-2**	X-3	C-2	X-3	C-2
Chronological age	9-8	10-4	10-5	11-1	0-9	0-9
Stanford Achievement total score	19	26	26	36	7	10
Age Equivalent	7-4	8-0	8-0	8-10	0-8	-10
Grade Equivalent	2.5	3.0	3.0	3.8	0.5	0.8

* X-3--Experimental Group

** C-2--Control Group

Thus it would appear a greater period of acoustic training is necessary before the speech of the deaf child is appreciably improved.

In educational achievement as measured by the Stanford Achievement Test Battery, both groups made almost identical gains, but neither group appeared superior as compared with the other.

Hudgins concludes that:

> The modern group hearing aid does not provide a new basic method in teaching the deaf, but it does augment the efficiency of proven methods. It lengthens the teacher's arm in every aspect of her teaching and enriches for the deaf child the quality of the general educational program.[19]

III. CENTRAL INSTITUTE'S EXPERIMENT

Introduction. Max Goldstein, otologist and founder of the Central Institute for the Deaf at St. Louis, Missouri, devoted most of his life to the education of the deaf. He was impressed with the experiment of Urbantschitsch in Vienna, which dealt with the training of the residual hearing through acoustic stimulation. Upon his return to America, Goldstein spent years in experimental research. He was a strong advocate of the oral methods for the

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[19] Ibid., p. 38.

education of the deaf. Perhaps, the following gives an insight as to his philosophy when he states;

> The mental operations of deaf children who are taught to speak differ in no essential respects from those of hearing children.
>
> Speech distinguishes man from the lower animals and is absolutely necessary to the highest psychological development. The deaf child who has learned to speak and to understand speech by modern methods may be but little, if any, handicapped mentally by his deafness, because the only necessarily undeveloped cerebral area is that employed in audition, the visual area being specially trained to take its place.[20]

With this philosophy being employed at Central Institute, all avenues of sensory training were used in the education of the deaf. The Acoustic Method as developed by Goldstein was used in conjunction with all oral methods.

Goldstein submitted the following experiment as a sample of the work being done at Central Institute with profoundly deaf children. He believed that acoustic stimulation would prove successful with profoundly deaf children.

Description of the subject. The following is the description of the subject used in the experiment at Central

---

[20] Max A. Goldstein, Problems of the Deaf (St. Louis: The Laryngoscope Press, 1933), p. 278.

Institute:

> A. L., female, age 11 years, was admitted to Central Institute when 3 years of age. No family history of deafness. Had measles, recurrent tonsillitis and rhinitis. When 5 years old and while a pupil at Central Institute for the Deaf, contracted polio; on recovery returned to school, showing no aftermath except moderate but noticeable lameness in left leg, which gradually improved. Tests of hearing at various intervals were all negative.
>
> Her scholarship was good; speech and lip reading fair. The Acoustic Method had never been used. When it was reported that some response to vowel sounds had been elicited, a select series of acoustic exercises was instituted.[21]

Description of Tests and Procedure. The following is a detailed description of the test used at Central Institute for the Deaf, and the procedure followed:

1. First approach through lip reading and amplification. (4 phrases)
2. Later phrases were repeated without lip reading. (repeated many times)
3. After 10 repetitions of 4 sentences the pupil with eyes closed, and the teacher's voice transmitted by Simplex Tubes to both ears, was able to repeat and differentiate all four sentences and produce the written form on the blackboard of each sentence as heard.

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[21] Max A. Goldstein, The Acoustic Method (St. Louis: The Laryngoscope Press, 1939), pp. 170-71.

PATIENT'S NAME A.L. OTHER RECORD

ADDRESS (Central Institute's pupil)

CHARTED BY

DATE Nov. 5, 1938

xLeft Ear x O Rt. Ear x x Air

FREQUENCY--CYCLES PER SECOND

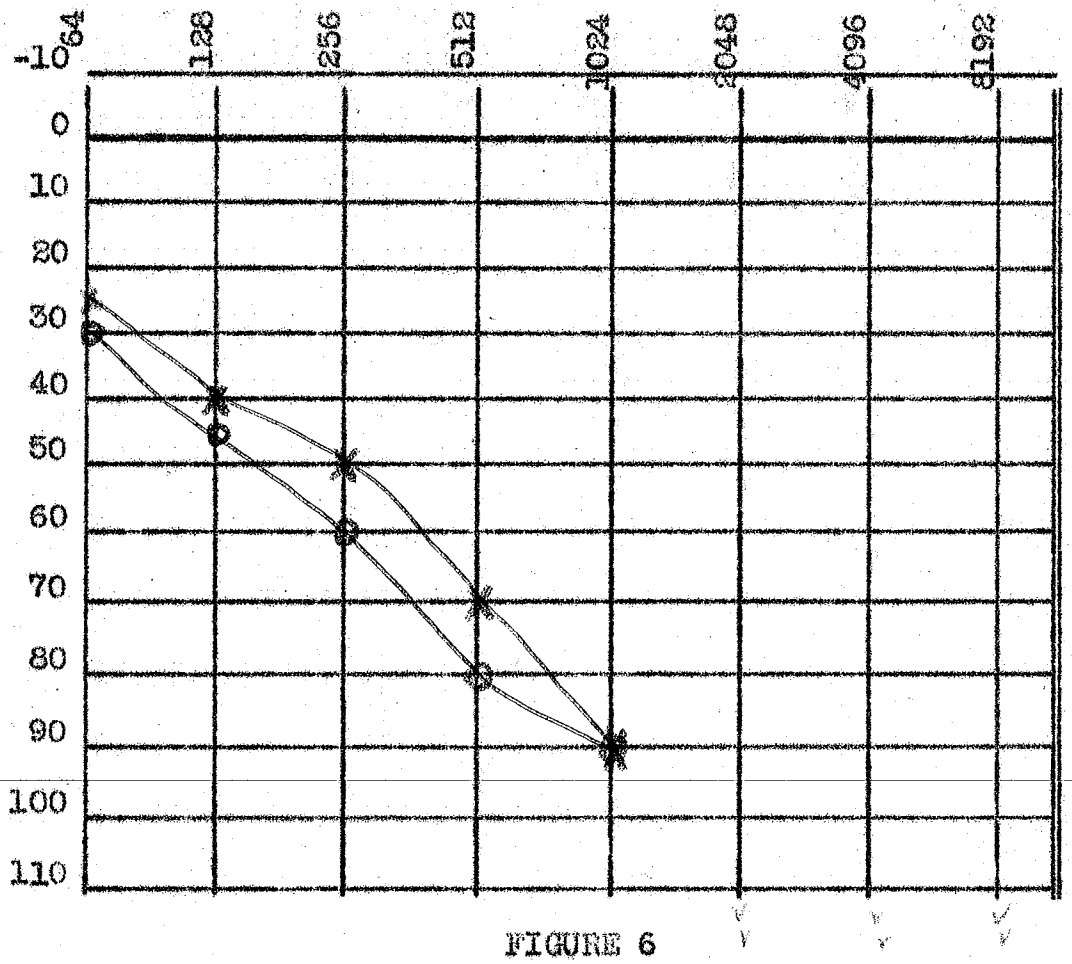

FIGURE 6

AUDIOGRAM

To determine the limitation of actual hearing impressions in this test, the vowels only as they occurred in the sentences were substituted for the entire spoken sentences.

ah oo a u (r) ow

Are you a Girl Scout?

ah-ee aw u(r) ee em i ī aw ning

I saw Shir- ley Temp-le this morning.

oo oo ah-ee an-ee

Do you like candy?

oo aw ning ah een

Good mor ning Ar lene.[22]

Result of Central Institute experiment. Goldstein, by daily, systematic acoustic stimulation, gained a response from a child profoundly deaf in the speech range. Since her loss was in the speech range, he attempted to stimulate the residual hearing by vowels alone. It appears the effect was the same as hearing both vowels and consonants. This is a new approach to the training of residual hearing. Goldstein reported:

---

[22] Ibid., p. 173.

> The response was the same as that elicited in giving the sentences in their complete form, thus offering further evidence that the pupil reacted only to her limitation of hearing vowel elements contained in the sentences, and this meager hearing, together with the tactile recognition of tempo and accent, constituted her only asset of interpretation.
>
> Is tactile impression, by this form of approach, gradually translated or converted into hearing sensation by some central stimulation or mental process?[23]

Since this child with a very limited amount of residual hearing responded to acoustic stimulation, it awakened educators to the possibility of training other deaf children who possessed a like amount of hearing. Many schools for the deaf have added this method of instruction to their daily program.

IV. EXPERIMENT BY THE INVESTIGATOR

Introduction. The investigator chose these children from her class in a public school in California. Daily, systematic auditory training was given these children. A group auditory training unit was used for all class instruction, and the children wore individual hearing aids at all other periods, both at school and at home.

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[23] Loc. cit.

These children are severely hard-of-hearing, and it appeared that they had some residual hearing which could be trained for useful hearing purposes. With this purpose in mind, speech and hearing was used in all classroom situations. Lip reading instruction was given daily, but when hearing and lip reading were combined, in every instance the effect was predominantly auditory, i.e., they appeared to hear.

Description of the subjects.

Galen

He is congentially deaf, probably due to measles during mother's pregnancy. From his behavior and the progress made, Galen appears to be above average in intelligence. His mother took the correspondence course offered by the John Tracy Clinic at Los Angeles, and has worked with him from the age of two and one-half years, until he entered the public school at the age of four years ten months.

At the time this test was given, Galen was six years three months of age. He is an excellent lip reader. He has had one and one-half years of auditory training. He wears a hearing aid when not using the group aid.

Vernon

He entered this special class last September at the age of five years ten months. The parents had previously

refused to recognize his hearing loss. Upon the recommendation of the family doctor, he was taken to an otologist. The otologist recommended that Vernon be placed in this special class for his education.

He was a shy, frightened little boy when he entered the class. He had no confidence in himself or others. After the first few days, he accepted the group amplification as part of his daily routine and asked for a headset.

His growth in all areas has been remarkable. He runs and plays and talks quite freely. He appears to be above average in intelligence.

After about six months of auditory training, he asked for a hearing aid. His parents purchased one at once. He wears it at all times when not using the group aid.

At the time this test was given, Vernon was six years three months of age. He is only a fair lip reader. He has had six months of lip reading and auditory training.

Sandra

She entered the special class last September at the age of five years one month. She has speech and vocabulary normal for a hearing child of her age.

Sandra had meningitis in 1950, and since then has had a moderate hearing loss. Upon the recommendation of the otologist she was placed in this class for lip reading,

speech development, and auditory training. The purpose was to preserve her good speech patterns which had been well established.

From all indications, she is above average in intelligence. She is a good lip reader. After a few months of auditory training, she asked for a hearing aid. One was obtained through the Crippled Children's Services.

At the time this test was given Sandra was five years five months of age. She had received lip reading and auditory training for a period of six months.

In September, 1952, Sandra will enter a regular first grade. She will be taken out each day for lip reading. She wears her hearing aid at all times.

Linda

She is congentially deaf, probably due to prenatal toxic neuritis. She has a slight spacticity in the right leg and foot. She entered this class at the age of six years eleven months. Speech at that time was limited to a few gutteral sounds.

There is a history of deafness in the family. Her sister is attending the School for the Deaf at Berkeley.

Linda had received no training prior to entering this class. She accepted the group amplification willingly, and in a short time wanted a hearing aid. The Shrine Club

purchased one for her. She wears it at all times when not using the group aid. Her voice and speech have greatly improved. Especially noticeable are the almost normal inflections of the voice. She can sing the scale with the teacher and stays on pitch.

At the time this test was given Linda was eight years three months of age. She is very alert and an excellent lip reader.

Gail

She is congentially deaf, probably due to measles in mother's pregnancy. She entered this class at the age of seven years seven months. She had very little speech.

Gail had been in the regular first grade for one year prior to entering this class, but no special help was given her. She attended a special summer clinical session at the College of the Pacific, Stockton, California, for ten weeks. This is the first time she had received any special education. She responded well to speech training.

Gail is an excellent lip reader. Reading is her favorite subject. Arithmetic is her weakest subject, but she is persistent in all subjects. She demands perfection of herself. She wears a hearing aid constantly when not using group amplification.

In musical therapy she has perfect rhythm. She is always dancing to music, matching her steps to the music she hears. She is an extrovert. From all appearances she is above average in intelligence.

At the time this test was given Gail was nine years of age. She had received one and one-half years of lip reading and auditory training.

Jesse

He entered school at the regular age, but made no progress in the regular classroom. He has spent one year in a class for the mentally retarded, prior to the opening of this class. The otologist recommended him to this class.

Jesse has very poor speech. He does not seem to understand what he hears. His reading is very poor. Arithmetic is his strongest subject. He accepted the group aid, but does not want to wear his hearing aid outside the classroom. This is probably due to the fact that he is older than the other children, and is at the age where he is very self-conscious. He is not forced to wear the aid.

He is a poor lip reader. He has been examined by the psychiatrist at the State Hospital and has been pronounced mentally retarded. Deafness is not his main affliction.

There is a family history of deafness. Two other children of school age have slight hearing losses. A baby sister two and one-half years of age is not attempting to talk. The otologist has recommended her to this class when she is three years old.

Jesse was twelve years five months of age at the time this test was given. He had had one and one-half years of lip reading and auditory training.

Comment on Audiograms. The investigator has submitted the following audiograms to assist the reader in getting a more accurate conception of the children's hearing. The audiograms were charted by the investigator, and the diagnosis' were made by the examining otologists.

In giving the test for hearing only, the better ear was used in each case, unaided by amplification or lip reading. No previous tests were given these children as a vocabulary had to be established before they were ready for testing.

These children wear hearing aids when not using the group amplification for class instruction. They mingle with hearing children at all times possible. They are given every opportunity to enrich their experiences.

Sandra is the only child who has had normal hearing. Her hearing loss is probably due to spinal meningitis.

PATIENT'S NAME GALEN OTHER RECORD Born 11-6-45

ADDRESS (Investigator's pupil) (Probable cause: Measles in

CHARTED BY M. Walker pregnancy.)

DATE 12-6-51 Fairly good responses.

xLeft Ear x O Rt. Ear x x Air

FREQUENCY--CYCLES PER SECOND

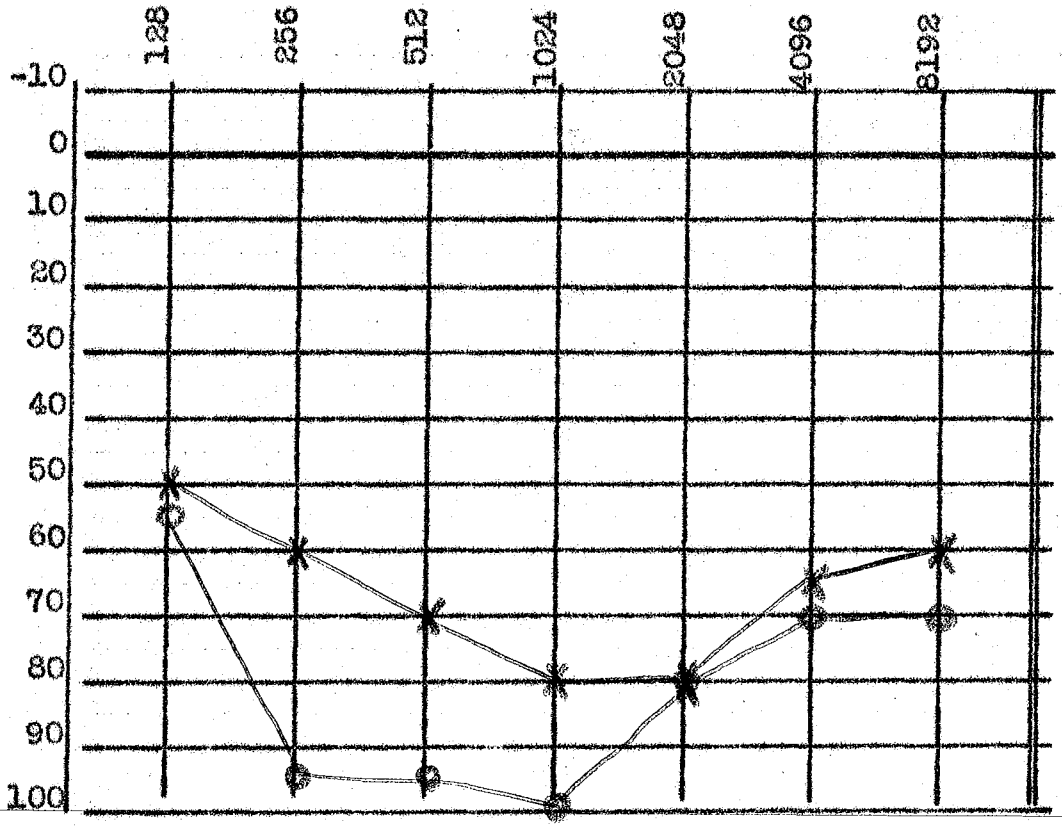

FIGURE 7

AUDIOGRAM

PATIENT'S NAME VERNON OTHER RECORD Born 10-31-45

ADDRESS (Investigator's pupil) Moderately severe, congenital,

CHARTED BY M. Walker bilateral, perceptive type

DATE 12-6-51 loss. Responses fair.

xLeft Ear x O Rt.Ear x x Air

FREQUENCY--CYCLES PER SECOND

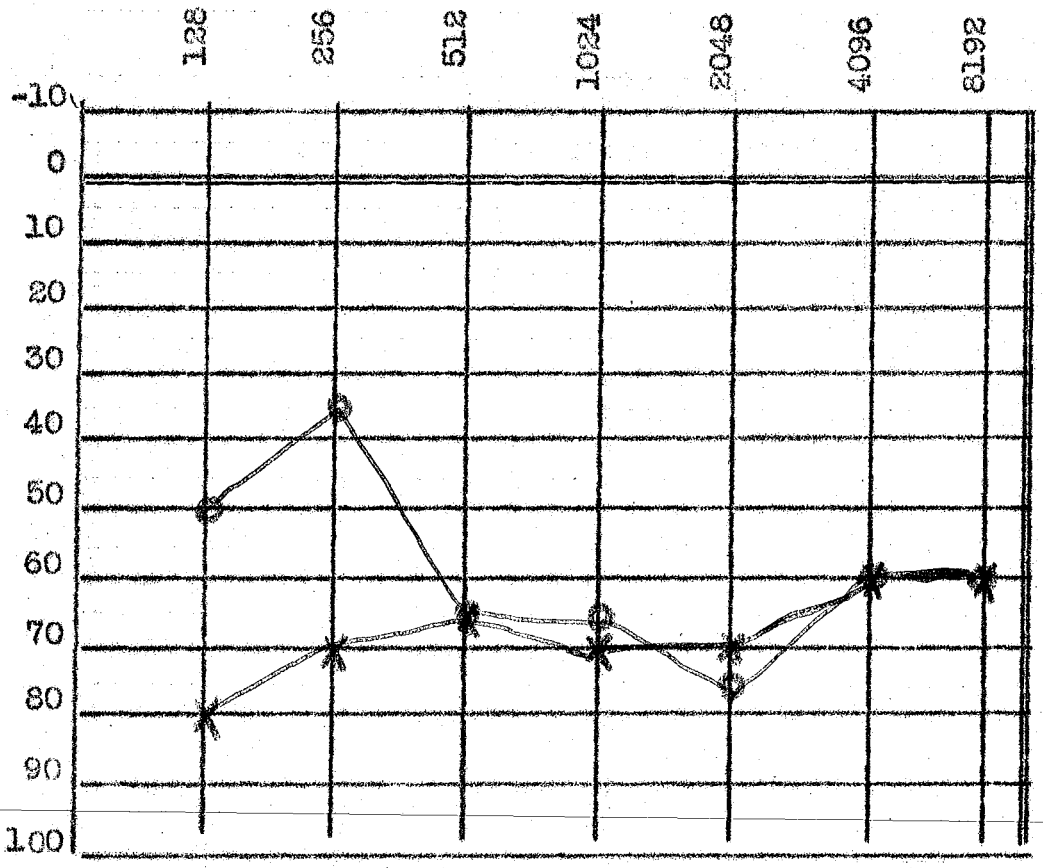

FIGURE 8

AUDIOGRAM

PATIENT'S NAME SANDRA OTHER RECORD Born 7-2-46

ADDRESS (investigator's pupil)

CHARTED BY M. Walker

DATE 12-6-51

X Left Ear x O Right Ear x
X Air

Probable cause: spinal meningitis in 1950. Bilateral, perceptive type loss. Normal speech. Good responses.

FREQUENCY--CYCLES PER SECOND

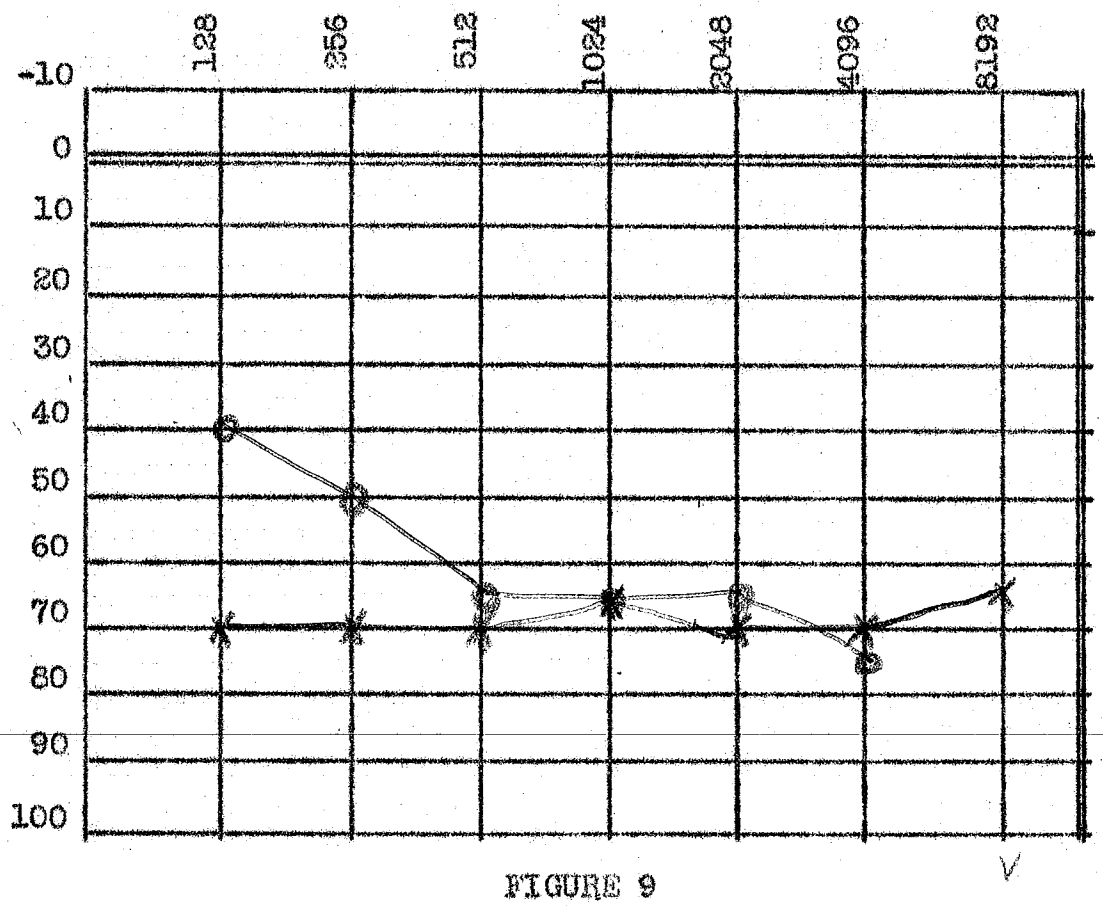

FIGURE 9

AUDIOGRAM

PATIENT'S NAME LINDA

ADDRESS (investigator's pupil)

CHARTED BY M. Walker

DATE 12-6-51

X Left Ear x O Right Ear x
x Air

OTHER RECORD Born 10-12-43

Probable cause: Prenatal toxic neuritis. Slight c.p. in right heel and leg. Good responses.

FREQUENCY--CYCLES PER SECOND

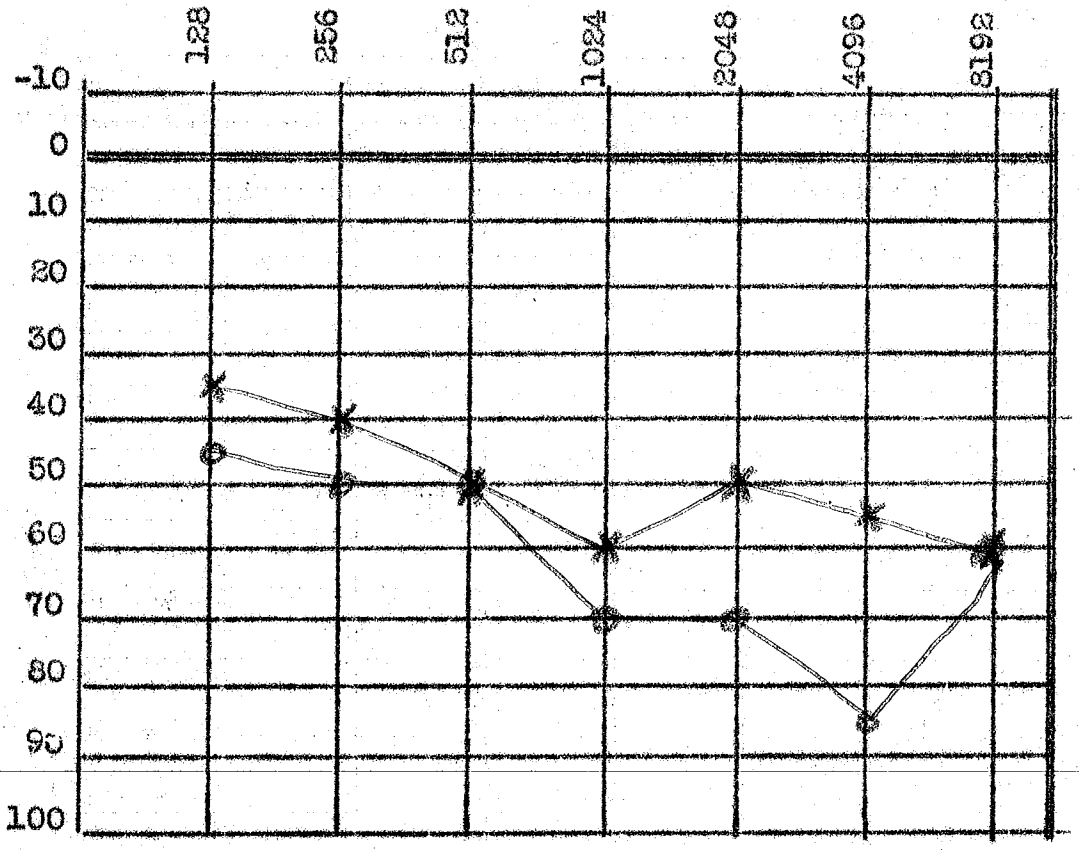

FIGURE 10

AUDIOGRAM

PATIENT'S NAME GAIL OTHER RECORD Born 1-9-43

ADDRESS (investigator's pupil) Probable cause: Measles in

CHARTED BY M. Walker pregnancy. Good responses.

DATE 12-6-51

X Left Ear x O Right Ear x
Air
x

FREQUENCY--CYCLES PER SECOND

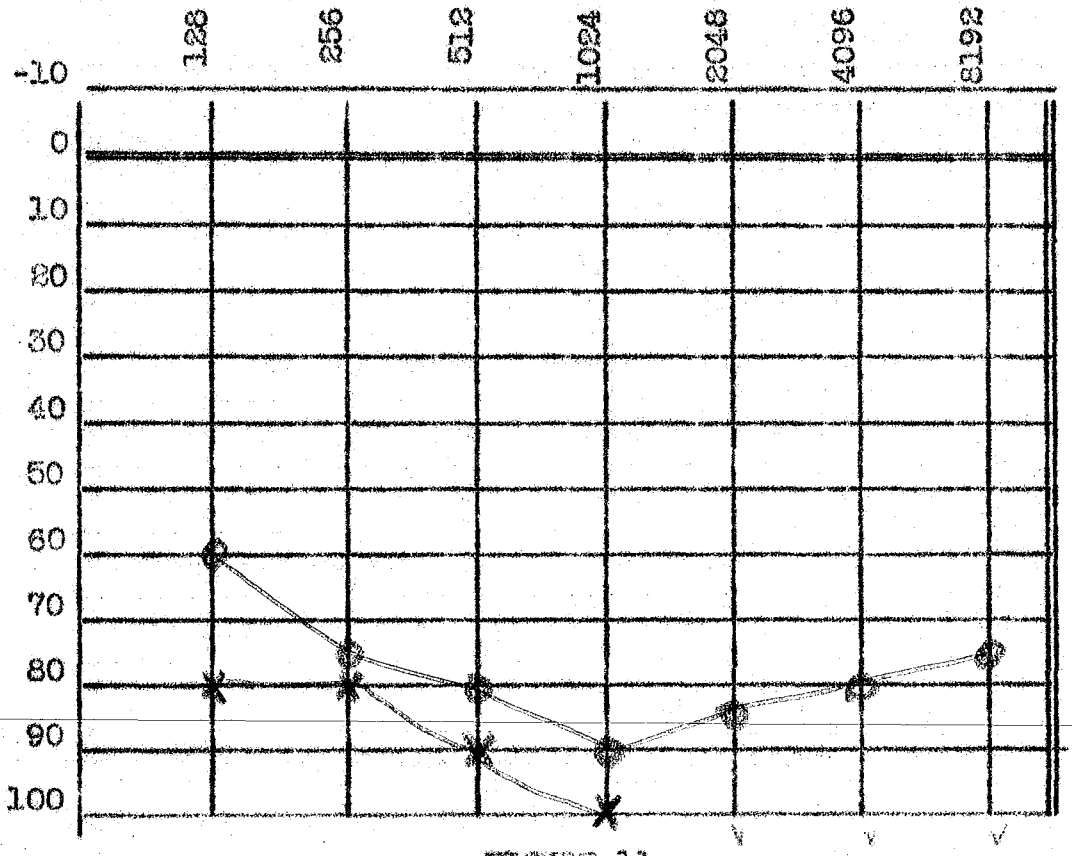

FIGURE 11

AUDIOGRAM

PATIENT'S NAME JESSE OTHER RECORD Born 7-29-39

ADDRESS (investigator's pupil) Probable cause: Blow on head

CHARTED BY M. Walker at 2 yrs., or mumps or

DATE 12-6-51 measles. Conductive type loss.

X Left Ear x O Right Ear x A and T 1-13-52. Good responses
x Air

FREQUENCY--CYCLES PER SECOND

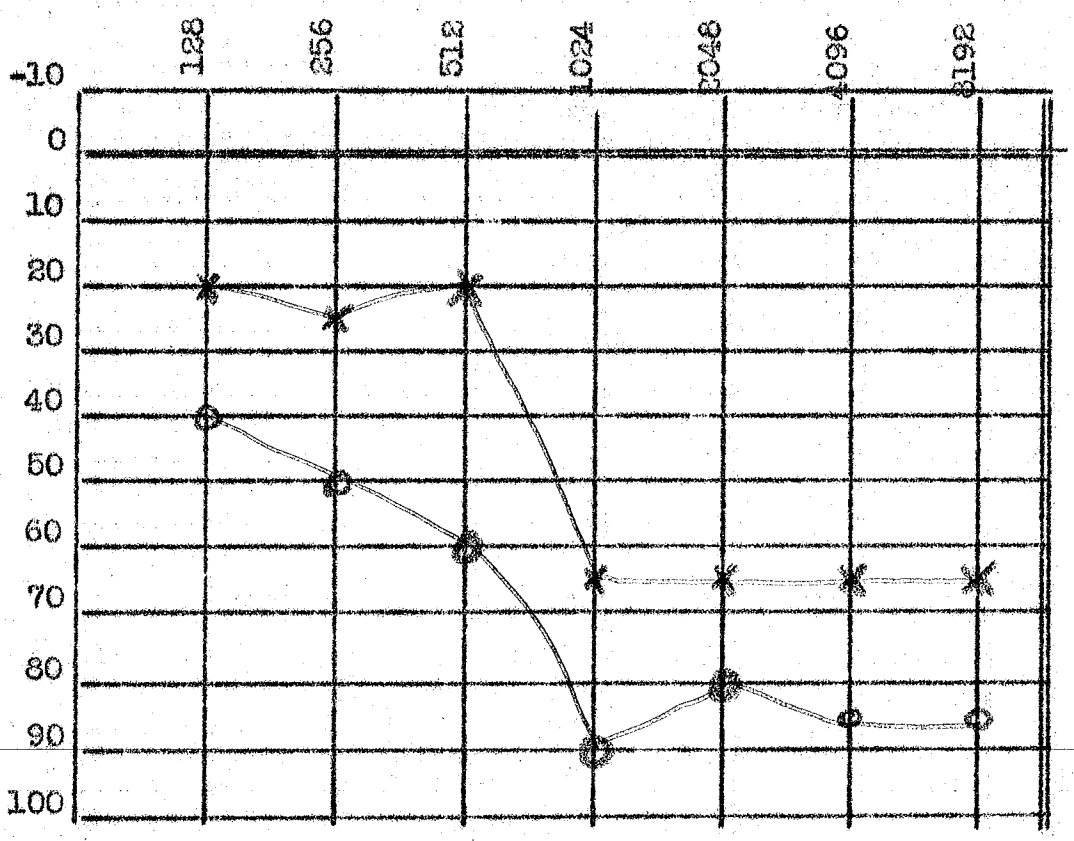

FIGURE 12

AUDIOGRAM

which she had in 1950. Every means is being used to preserve her good speech patterns.

Description of tests and procedure used. In constructing this test, the investigator used words familiar to all the children. These words had been used in daily conversation, reading, and language. The children had not been instructed with the test in mind. The test was not discussed at any time, and had not been seen by the children prior to the testing time.

Twenty-one words were selected for the test. These words contained all consonant sounds in their initial position. Four separate lists were made, listing the words in different order each time. The order of testing: (1) Lip reading only; (2) Hearing aid only; (3) Unaided ear only; (speaking into the better ear); and, (4) Lip reading and hearing aid combined.

The investigator selected eighty-one pictures from current magazines for the testing material. These pictures often contained several items, so that the child must hear or lip read the correct word in order to make the right selection. These pictures were mounted on uniform pieces of heavy cardboard.

Simple verbal instructions were given each child by the investigator before beginning the tests. After that

there was no conversation. The child was told that several pictures would be placed before him. He was told to watch the teacher closely and hand her the picture that matched the word he saw or heard. The teacher placed four pictures before the child, one of these pictures contained an item on the test list of words. She pronounced the word clearly once. In most cases, the child repeated the word after the teacher as he looked over the pictures. Then the child handed the teacher the picture which he thought corresponded to the word spoken by the teacher. The teacher marked each word heard correctly on a score sheet kept for each child.

The pictures were changed around for each word to be tested. In this way, there was no chance for memorizing. The child must be alert at all times as he had no idea which four pictures would be placed before him.

Table IX, page 64, shows the list of words used by the investigator in giving these speech perception tests.

Results of experiment. Table XI, page 66, shows gains made in speech perception after auditory training period of from six months to one and one-half years. By comparing column B with column C the gains made by the use of a hearing aid, either group or individual, is noted.

Vernon has been the only pupil who did not show a gain. This could be due to the fact that he had had only

TABLE IX

SPEECH PERCEPTION TESTS (CONSONANTS)

Lip reading only	Hearing aid only	Unaided ear only	Lip reading and hearing aid
bread	dishes	key	pie
lamp	water	rug	chair
key	fish	house	telephone
pie	knife	wheel	shirt
dishes	sleep	milk	wheel
zebra	bread	thumb	sleep
rug	rug	zebra	key
chair	telephone	lamp	rug
water	house	valentine	knife
telephone	shirt	glass	house
jello	wheel	telephone	thumb
fish	thumb	fish	lamp
house	lamp	bread	water
valentine	zebra	water	fish
shirt	chair	chair	milk
glass	pie	shirt	zebra
knife	jello	knife	dishes
wheel	key	pie	valentine
milk	valentine	sleep	bread
sleep	glass	dishes	jello
thumb	milk	jello	glass

Word lists used by investigator.

TABLE X

RESULTS OF TESTS MADE BY THE INVESTIGATOR
SPEECH PERCEPTION TEST SCORES

Pupil---Age		Lip reading only A	Hearing aid only B	Unaided ear only C	Lip reading and hearing combined D
Galen	6-3	100%	100%	66.6%	100 %
Vernon	6-3	85.7%	76.1%	80.9%	95.2%
Sandra	5-5	95.2%	100%	100 %	100 %
Linda	8-3	95.2%	100%	95.2%	100 %
Gail	9-0	95.2%	90.4%	47.6%	100 %
Jesse	12-5	71.4%	100%	95.2%	100 %

The above figures are the results of tests given after extensive use of amplication in daily instruction, by the investigator.

TABLE XI

GAINS MADE IN SPEECH PERCEPTION
AFTER AUDITORY TRAINING

Pupil---Age		Hearing aid only B	Unaided ear only C	Percentage gains
Galen	6-3	100 %	66.6%	33.4%
Vernon	6-3	76.1%	80.9%	-4.8%
Sandra	5-5	100 %	100 %	0.0%
Linda	8-3	100 %	95.2%	4.5%
Gail	9-0	90.4%	47.6%	42.8%
Jesse	12-5	100 %	95.2%	4.8%
Average gain				13.4%

six months' training with amplification.

Table XII, page 68, shows gains made in speech perception after auditory training period of from six months to one and one-half years. By comparing column A with column D the gains made by combining lip reading and hearing aid is noted.

Vernon shows a slight increase with the use of the aid, signifying that his hearing is better than his lip reading ability. He had had only six months' training when these tests were made.

In Jesse's case, it would seem that his mental retardation might have affected his ability to lip read.

Summary. It is significant that in all cases except Vernon's, the hearing aid has made a definite contribution to better speech perception. These limited tests are an indication that there is a possibility of a new world being opened for deaf children. They are not conclusive, but are worth further study and experimentation.

According to Macfarlan,

> The visual and auditory speech interpretation centers will not develop effectively unless they are trained to receive and to perceive speech simultaneously.[24]

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[24] Douglas Macfarlan, "Using Residual Hearing," Hearing News (Washington, D.C.: American Hearing Society, November, 1939), p. 3.

TABLE XII

GAINS MADE IN SPEECH PERCEPTION
AFTER AUDITORY TRAINING

Pupil---Age		Lip reading only A	Lip reading and hearing combined D	Percentage gains
Galen	6-3	100 %	100 %	0.0
Vernon	6-3	85.7%	95.2%	9.5%
Sandra	5-5	95.2%	100 %	4.8%
Linda	8-3	95.2%	100 %	4.8%
Gail	9-0	95.2%	100 %	4.8%
Jesse	12-5	71.4%	100 %	28.6%
Average gains				8.7%

The purpose of this chapter has been to submit evidence which attempts to show the increase made in speech perception after long periods of auditory training. These experiments were made by various people in various parts of the world. In every incident, the results show a definite increase in speech perception. It is possible if children in the many schools for the deaf were tested, the results would be very similar, as more and more schools are using the acoustic method as an educational tool.

CHAPTER V

THE QUESTIONNAIRE RESULTS

Introduction. The purpose of this chapter is to compare the use of auditory training in State and Private Schools for the Deaf in the United States, Hawaii, and Puerto Rico, for the years 1939-1940 with 1951-1952. The chief objectives are: to ascertain if there was an increase in the use of auditory training in the educational programs in the schools for the deaf, to inquire into the methods of instruction used in the schools for the deaf, and to obtain information as to the use of lip reading and hearing combined in the instruction of deaf children.

Philosophies. There are two distinct philosophies underlying the education of the deaf child in the state and private schools.

There are those who believe in the use of speech exclusively (the oral method). Lip reading has been their chief tool. These educators were the first to accept the acoustic method as an additional aid in the education of the deaf child. They have experimented and found improvement in speech, speech perception, and voice quality through the combined use of hearing and lip reading. In many schools, all children are given auditory training, regardless of the

degree of hearing loss.

The other group of educators were less prone to accept auditory training so eagerly. They seemed to doubt the value of auditory training with profoundly deaf children. They were inclined to use auditory training only with those who showed a considerable amount of residual hearing. In these schools, both oral and manual methods were employed in the educational process.

Procedure. Questionnaires were sent to sixty-five public and private schools for the deaf throughout the United States, Hawaii, and Puerto Rico.[1] The educational data on the public and private schools for the deaf for 1939-1940 were obtained from the United States Department of Education.[2] The investigator attempted to ascertain whether or not there was a trend toward the more general use of auditory training in the schools for the deaf, and to determine if lip reading and hearing were being combined in these schools.

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[1] See Appendix A.

[2] Statistics of Special Schools and Classes for Exceptional Children, Vol. II, Chapter V. Biannial Survey of Education in the United States, 1938-1940 (Washington, D.C.: United States Department of Education, 1942), pp. 143-151.

In the survey of educational methods used in the state and private schools for the deaf, separate questionnaires, with explanatory letters, were sent to each school. Of the sixty-five schools contacted through the questionnaire, thirty-three state schools and fifteen private schools responded, or 73.8 per cent.

In the survey made by the United States Department of Education, forty state schools and nineteen private schools reported. Some of the same state and private schools reported in both surveys.

A lapse of twelve years between the surveys points to a difference in educational methods and attitudes in both the state and private schools.

An unusual degree of interest in the subject under consideration was shown by the marginal notes, letters, and suggestions received by the investigator. The investigator was deeply grateful for the many helpful suggestions offered by the educators in the state and private schools for the deaf. The nature of the questions asked will be clarified later in this chapter.

Comparative study of the questionnaire. Table XIII shows the time allotted to auricular training in the state and private schools for the deaf for the years 1939-1940.

TABLE XIII

COMPARATIVE STUDY OF AUDITORY TRAINING

Auditory Training Periods	State Schools 40		Private Schools 19	
	1939-1940[a]	1951-1952[b]	1939-1940[c]	1951-1952[d]
Full time only--for all	0	2	0	4
Full time for some) part time for some)	1	13	2	6
Part time only--for all	1	11	5	2
Part time for some) Not at all for some)	11	0	2	1
Not used at all	3	0	1	0
Full time for some) Part time for some) Not used for some)	17	6	8	2
Full time for some) Not used with some)	1	1	0	0
Schools not reporting information	6	0	1	0

[a] Appendix B.

[b] Appendix C.

[c] Appendix B.

[d] Appendix C.

The reader will observe that in 1939-1940, three state schools and one private school did not use auditory training at all, and no state or private school offered full time auditory training to all the pupils. But several state and private schools offered auditory training full time to some pupils and part time to others. In most of the state and private schools auditory training was offered full time to some pupils, part time to others, and not used at all with some students. Probably the amount of residual hearing was taken into consideration when selecting the pupils for auditory training. Many educators felt that pupils with very severe hearing losses could not profit much from auditory training.

Table XIII shows the time allotted to auditory training in the state and private schools for the deaf for the years 1951-1952. This information was obtained by a questionnaire sent out by the investigator. It was noted that thirteen state schools and six private schools offered full time auditory training for some of the pupils and the rest of the pupils received part time auditory training. No child in these schools was deprived of auditory training. These schools comprise about 33 1/3 per cent of the schools answering the questionnaire. It may be assumed that many of

the state and private schools are recognizing the value of daily auditory training as a part of the educational program.

The time allotted to full time auditory training varied. Some schools devoted as much as five hours each day to instruction with amplification for all or part of the students. One large state school reported 50 per cent of their students enrolled in the "acoustic division," in which these students received full time auricular training. This same school has a manual division, and in this section the students did not receive any auditory training.

In some of the state and private schools, the older children received full time auditory training, while the younger ones received it only part time. The schools have tried to adjust their programs to meet the needs of the children. I no two schools was the program exactly alike.

Table XIV shows the methods of instruction used by the state and private schools for the deaf for the years 1939-1940.[3] The reader will note that only three state schools and fourteen private schools used speech exclusively (oral method). No school used the manual method

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[3] See Appendix B.

TABLE XIV

COMPARATIVE STUDY: METHODS OF INSTRUCTION

Method of Instruction	State Schools		Private Schools	
	40	33	19	16
	1939-1940[a]	1951-1952[b]	1939-1940[c]	1951-1952[d]
Speech only--for all	4	4	14	14
Manual only--for all	0	0	0	0
Speech--for some) Manual--for some)	11	1	0	0
Speech and manual combined--for all	0	14	3	0
Speech--for some) Manual--for some) Speech and manual) combined-for some)	14	4	2	0
Speech--for some) Speech and manual combined--) for some)	6	6	0	1
Manual--for some) Speech and manual combined--) for some)	2	0	0	0
Schools not reporting information	3	4	0	0

[a] Appendix B.

[b] Appendix C.

[c] Appendix B.

[d] Appendix C.

exclusively. Eleven state schools used the oral method with some pupils and the manual method for others. No state school taught every pupil both speech and manual as a combined method, while three private schools used the combined method of instruction. Fourteen state schools and two private schools taught some of the pupils speech only, while some pupils used the manual method exclusively. In the same schools, other pupils received instruction by the combined method. It may be assumed the same criterion was used for selecting methods of instruction as was used in selecting those who might profit from auditory training, i.e., the degree of hearing loss.

Table XIV also shows the methods of instruction used in the state and private schools for the deaf for the years 1951-1952.[4] The information was acquired from the questionnaire sent out by the investigator.

There appears to be an increase in the number of state schools which are using the combined method, i.e., speech and manual for instructional purposes. There was only one private school in which speech was not used exclusively for instruction. There is a sharp decline in the number of state schools which were using the manual

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[4] See Appendix C.

method only, as a method of instruction for some pupils.

Questionnaire responses. Response to the question: Do you combine amplification with lip reading during regular classroom work?

The replies were varied, due perhaps to the lack of acoustical equipment in many of the state schools for the deaf. Some state schools indicated that it was desirable, but they were somewhat limited due to the many classes in their programs.

As show in Table XV, hearing and lip reading combined was used in some degree in 90 per cent of the state schools for the deaf and in 93 per cent of the private schools for the deaf. This was a very good indication that the educators in the state and private schools for the deaf were finding auditory training valuable in the education of the deaf child.

Many of the questions were very subjective in nature and were somewhat colored by personal opinions. These have no true value, and were not charted for further use. However, in most cases, all the educators agreed that auditory training had made a favorable difference in the development of speech, speech perception, and voice quality in some of the children. Each child had different problems to meet, and there was no "yes and no" answer which would

TABLE XV

PERCENTAGE OF STATE AND PRIVATE SCHOOLS FOR THE DEAF COMBINING HEARING AND LIP READING

Hearing and lip reading combined in classroom Responses:	State schools 33*	Private schools 15**
yes	17	13
yes, with some	10	0
one class only	1	0
yes, at times	1	0
yes, with most	0	1
yes, primary and intermediate	1	0
no, lip reading suffers	1	1
no report given	2	0
Per cent of schools combining hearing with lip reading	90%	93%

* Appendix C.

** Appendix C.

apply for all deaf children.

Many of the state schools kept a very flexible program that could be adjusted at any time to meet the needs of the child. If the child seemed to respond to auditory training, he was given an opportunity to have it for a longer period of time. Most educators felt the amount of residual hearing which was present would determine how much amplification the child would receive. A few educators stated vigorously that it was a "must" in their school programs.

As to the wearing of the hearing aid in after school hours, the response was somewhat divided. Many felt that it is a valuable asset to wear one for any occasion, while others suggested its use for movies, television, church, etc., only. Perhaps this response was due to the possibility of the hearing aid being broken on the playground.

Summary. In this chapter an effort was made to compare the educational data of the state and private schools for the deaf for the years 1939-1940 with 1951-1952. The fact that 73 per cent of the questionnaires were returned, answered in full, was a good indication that the state and private schools were interested in the subject under discussion.

It is significant that in 33 1/3 per cent of the state and private schools all of the children are receiving auditory training, some full time and others part time. In 1939-1940 there were no schools offering full time auricular training to the students, but in 1951-1952 there were two state and four private schools offering full time auricular training for all students.

In 1939-1940 three state schools and one private school did not use auditory training, while in 1951-1952 there was not a single school which did not offer auditory training as a part of the educational program. Perhaps the true value lies in the fact that auditory training was being used with some success in all of the schools for the deaf throughout the United States and Puerto Rico.

Conclusion. While the weaknesses of the questionnaire technique as a means of gathering data preclude any final definite conclusions, there seemed to be enough evidence to substantiate a number of rather significant possibilities.

1. It was apparent that administrators in the schools for the deaf were very much aware of the possible value of auditory training, and were willing to investigate further.

2. Because of this awareness administrators and teachers were recommending the more general use of auditory training with the profoundly deaf child.

3. There is some evidence that a few of the schools for the deaf have set up an auditory training department, and teachers especially trained for this method of education are conducting the programs.

Finally, in summation, it seemed evident that the auditory training programs in most of the state schools and in a few of the private schools are still in the experimental stage, but that more and more educators of the deaf are looking favorably upon auditory training as an additional educational tool.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary. The purpose of this study was to investigate the value of auditory training in the development of speech perception in deaf children, and to establish the value of acoustic stimulation as a part of the educational program in the schools for the deaf. An attempt was made to answer the following questions:

1. Do congentially deaf children respond to auditory training?
2. How is the presence of residual hearing ascertained?
3. Are the schools for the deaf using auditory training as a part of their educational programs?
4. Do the pupils tested for speech perception show an increased ability following a period of auditory training?

As early as the first century, Archigenes, a Greek physician, was interested in helping those with defective hearing. He fashioned a crude trumpet to transmit amplified sound to the deaf. Work with the deaf proceeded spasmodically down through the centuries. In the middle of the eighteenth century Ernaud, a French physician,

experimented with deaf children who appeared to have residual hearing. He trained them to differentiate various vocal sounds. Itard, a French otologist, practiced with six deaf children for one year. He noticed that an increased hearing perception was being developed.

No doubt the scientific experiment of Urbantschitsch in 1893 did more to advance the theory of training the residual hearing of deaf children than all previous experiments. But it was Goldstein who developed the acoustic method for training the residual hearing of deaf children for better speech perception.

Irene and A. W. G. Ewing have been pioneers in this field in England. By their experiments during the past twenty-five years, they have attracted the attention of educators of the deaf on both sides of the Atlantic. In 1949 they visited the United States and taught summer courses in lip reading and auditory training at Northwestern University in Chicago. They have done much to encourage the use of auditory training as a means of increasing speech perception in the profoundly deaf child.

Goldstein at Central Institute for the Deaf in St. Louis, has been the foremost authority on the training of residual hearing of deaf children in the United States. His work is being carried on in the many state and private

schools for the deaf throughout the country. He believed that no child should be denied auditory training because of a severe hearing loss. He insisted that we do not know where vibratory sensation ends and hearing begins, therefore, all deaf children should receive daily auditory stimulation as a means of training whatever residual hearing might be present.

In more recent years, Hudgins of Clarke School for the Deaf at Northampton, Massachusetts, has been a vigorous supporter of auditory training as a means of increasing the speech perception of deaf children. He has used every modern acoustical invention to further his research at Clarke School. He believes that all children should be given auditory training, and goes along with the Ewings and Goldstein in combining hearing and lip reading as the ideal method of teaching deaf children. These authorities believe in using every avenue of approach in the education of the deaf.

The writer began using auditory training with the children in her class, and began to notice that when she sometimes spoke and had her back to the children she got a response. More intensive study was done along this line and the children were happy to respond when she held a paper in

front of her face. The children enjoyed playing a game in which they tried to see who could understand the most words by hearing alone. They became very conscious of "hearing" and they would respond with "I hear." As the children used lip reading and hearing in all their academic work, the writer became convinced that the speech perception was improving. The test experiment further proved that these children were benefiting by the use of auditory training.

In the experiments presented by the Ewings in England, the Clarke School for the Deaf at Northampton, Massachusetts, Goldstein at Central Institute for the Deaf at St. Louis, and the investigator, all tests indicated that congentially deaf children do respond to auditory training. This conclusion was made after giving a series of tests, first, with lip reading only; second, with hearing aid only; third, with unaided ear only; and, fourth, by combining lip reading with hearing. The subjects used in the tests had received auditory training over different periods of time, prior to the testing.

The presence of residual hearing in profoundly deaf children was most accurately ascertained by giving a series of reflex tests by an otologist. In these tests, certain parts of the body responded spontaneously when the nerve endings in the labyrinth of the ear were stimulated to a

certain degree. When spontaneous reactions occur at the time of stimulation, the conclusions are that some residual hearing is present. By daily auditory training, this residual hearing can be trained to be useful in learning speech. The success of the pupil depends largely upon the amount of residual hearing present.

By making a comparative study of the auditory training programs in the state and private schools for the deaf, for the years 1939-1940 with 1951-1952, the trend toward the more general use of auditory training was indicated. Of the forty state schools reporting for 1939-1940, twenty-nine had some pupils receiving no auditory training at all. In eleven private schools out of the nineteen reporting for the same year, only part of the students were receiving auditory training.

In 1951-1952, out of the thirty-three state schools for the deaf reporting in a questionnaire sent out by the investigator, only seven of these schools had some pupils not receiving some auditory training. In only three out of the fifteen private schools reporting were there some pupils not receiving auditory training.

In the tests submitted, all children made appreciable gains by combining lip reading and hearing, except Sandra, who is not a congentially deaf child, and who

has only recently suffered a hearing loss. Vernon did not show any gain when comparing his own hearing and that of hearing by amplification, probably because he had not fully adjusted to the use of an aid. However, he could "hear" better when lip reading and hearing was combined than when relying upon lip reading alone. From this evidence it was concluded that the gain was due to daily auditory training.

Conclusions. From the results of this investigation, there seems to be enough evidence to substantiate the following statements:

1. There are very few profoundly deaf children who do not possess some residual hearing.

2. The presence of residual hearing can be verified by modern reflex tests as given by an otologist. The audiometric reading is not to be taken as the final proof that the child does not possess some residual hearing.

3. Profoundly deaf children do respond to auditory training, if some residual hearing is present.

4. Auditory training has been found to be valuable in educating the deaf, as indicated in the educational programs of all of the thirty-three state and fifteen private schools for the deaf reporting through the questionnaire sent out by the investigator.

5. Profoundly deaf children do have better speech perception after having received daily auditory training over a period of time. The children tested by the Ewings, Goldstein, Hudgins, and the investigator, scored higher by combining lip reading with hearing in every case.

Of the thirty-three state schools for the deaf reporting for 1951-1952, two schools did not answer the question pertaining to the use of lip reading and hearing combined in the classroom. But out of the thirty-one state schools which did report, only one school did not combine these two valuable educational tools at least part of the time with part of the pupils. Out of the fifteen private schools reporting for 1951-1952, only one school did not combine lip reading and hearing in the classroom.

The administrators of the both state and private schools for the deaf are recognizing the value of auditory training and are including it in the educational programs of the schools. With the advancement of acoustical equipment, more auditory training will be included in the various schools for the deaf.

Recommendations. From the investigation, as presented, it is concluded that there is a definite need for further research into the relationship of auditory training

to speech perception. The following problems might offer more information on this vital subject:

1. An investigation into the acoustical equipment used in the state and private schools for the deaf.
2. An investigation into the advancements being made by acoustical laboratories in providing equipment for auditory training.
3. An investigation into the auditory training programs now being conducted by the state and private schools for the deaf in the United States.
4. An investigation into the modern methods of testing for residual hearing as used by the otologists through the United States.
5. A standardized test for ascertaining the gains made in speech perception after a certain period of auditory training.

The writer is especially interested in having a standardized speech perception test available so those working with the deaf children might have some idea as to what to expect of the deaf child with residual hearing which has been trained by auditory training. This would enrich our knowledge of the opportunities available for

deaf children.

This study in no way is the final solution to the educational problem of the deaf, but merely offers a ray of hope. With modern acoustical equipment, it is possible that a new world of sound will be opened up to the profoundly deaf child. It is hoped that this effort may encourage those who are deaf and be helpful and inspirational to the teachers of the deaf.

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APPENDIX A

THE VALUE OF AUDITORY TRAINING

A questionnaire

1. Do you advocate the use of amplification (either group or individual hearing aid) for all instruction?

   Yes_____ No_____

2. How many hours of the school day do your students use amplification? Number of hours _____

3. Do you combine amplification with lip reading during regular classroom work? Yes_____ No_____

   Explain _____

   _____

   _____

   _____

4. Have you made any tests to investigate what definite help auditory training has been in word or sound discrimination? Yes_____ No_____

5. Are the results of your investigation available?

   Yes_____ No_____

   If yes, how may one obtain them?_____

   _____

6. What are your conclusions on the value of auditory training?

   Explain_____

7. In your experience, is auditory training valuavle in the development of residual hearing of a severely hard of hearing or deaf child? Yes_____ No_____

Explain_____

8. In your experience, has the use of auditory training made an appreciable difference in the educational and emotional life of the child? Yes_____ No_____

Explain_____

9. Do you advocate the use of the hearing aid in the out-of-school hours? Yes_____ No_____

Why?_____

10. Has auditory training made an appreciable difference in the development of speech in these children?

Yes_____ No_____

Explain_____

_____

_____

_____

11. Does auditory training tend to aid in the development of more natural speech (rhythm, inflection) in these acoustically handicapped children? Yes_____ No_____

Explain_____

_____

_____

_____

12. Any information pertinent to the topic under discussion, may be written here.

_____

_____

_____

_____

13. Auricular training: (Check) (In your school)

(a) Full time use _____

(b) Part time use _____

(c) Not used at all ____

Method of instruction: (check) (In your school)

(a) Exclusive use of speech _____

(b) Exclusive use of manual alphabet_____

(c) Use of both _____

Name of school:_____

City_____State_____

Name of person answering questionnaire_____

Title or position of person_____

(Questionnaire sent out by Martha Walker, 312 E. Roseburg Ave., Modesto, California. Research for Master's thesis.)

APPENDIX B

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940

Institution	Pupils white	Pupils negro	Auricular Training: Full time	Auricular Training: Part time	Auricular Training: Not used	Methods Used speech	Methods Used manual	Both (speech and manual combined)
Alabama Institute for the Deaf, Talladega, Alabama	306	0			306	273	33	
Arizona State School for the Deaf, Tucson, Arizona	94	1	10	19	66	36	4	55
Arkansas School for the Deaf, Little Rock, Arkansas	236	29		155	110	143	110	12
California School for the Deaf, Berkeley, California	325	2	22	96	209	159	99	69
Mystic School for the Deaf, Mystic, Connecticut	90	0	28	31	31	90		
Colorado School for the Deaf, Colorado Springs, Colorado	203	1		89	115	176	28	

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940 (continued)

Institution	Pupils white	Pupils negro	Auricular Training Full time	Auricular Training Part time	Auricular Training Not used	Methods Used: speech	Methods Used: manual	Methods Used: Both (speech and manual combined)
Florida State School for the Deaf, St. Augustine, Florida	190	47	28	151	58	170	47	20
Ephpheta School for the Deaf, Chicago, Illinois	77	0		46	31			77
Illinois School for the Deaf, Jacksonville, Illinois	493	30	158	24	341	250		273
Indiana State School for the Deaf, Indianapolis, Indiana	418	21	23	70	346	393	46	
Iowa School for the Deaf, Council Bluffs, Iowa	365	5	45		325	330	40	
Kansas School for the Deaf, Olathe, Kansas	186	3			189	78	24	87

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940 (continued)

Institution	Pupils: white	Pupils: negro	Auricular Training: Full time	Auricular Training: Part time	Auricular Training: Not used	Methods Used: speech	Methods Used: manual	Methods Used: Both (speech and manual combined)
Kentucky School for the Deaf, Danville, Kentucky	330	24		40	314	252	102	
Maine School for the Deaf, Portland, Maine	102	0	6	20	76	96		6
Maryland School for the Deaf, Frederick, Maryland	179	0	34	50	95	154	15	10
Reinhardt School for Deaf Children, Kensington, Maryland	11	0		11		11		
Beverly School for the Deaf, Beverly, Massachusetts	85	0		85		85		
Clarke School for the Deaf, Northampton, Massachusetts	144	0	60	45	39	144		

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940 (continued)

Institution	Pupils: white	Pupils: negro	Auricular Training: Full time	Auricular Training: Part time	Auricular Training: Not used	Methods Used: speech	Methods Used: manual	Methods Used: Both (speech and manual combined)
Boston School for the Deaf, Randolph, Massachusetts	159	3	37	115	10	162		
Evangelical Lutheran Institute for the Deaf, Detroit, Michigan	88	1		30	59	82		
Michigan School for the Deaf, Flint, Michigan	415	5		272	148	272	57	91
Minnesota School for the Deaf, Faribault, Minnesota	273	0	18	42	213	212		61
Mississippi School for the Deaf, Jackson, Mississippi	149	58				53	26	128
Missouri School for the Deaf, Fulton, Missouri	331	23	109	76	169	209	71	74

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940 (continued)

Institution	Pupils white	Pupils negro	Auricular Training Full time	Auricular Training Part time	Not used	Methods Used: speech	Methods Used: manual	Both (speech and manual combined)
Central Institute for the Deaf, St. Louis, Missouri	113	0	21	92		113		
Montana School for the Deaf, Great Falls, Montana	85	0		20	65	85		
Nebraska School for the Deaf, Omaha, Nebraska	182	2		88	96		30	154
New Jersey School for the Deaf, West Trenton, New Jersey	375	12	36	210	141	387		
New Mexico School for the Deaf, Santa Fe, New Mexico	135	0				125	10	
St. Mary's School for the Deaf, Buffalo, New York	262	2	51	180	33	203	21	40

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940 (continued)

Institution	Pupils white	Pupils negro	Auricular Training: Full time	Auricular Training: Part time	Auricular Training: Not used	Methods Used: speech	Methods Used: manual	Methods Used: Both (speech and manual combined)
Cleary Oral School, Lake Ronknkoma, New York	7	0	6	1		7		
Lexington School for the Deaf, New York, New York	284	17	80	101	120	301		
Wright Oral School, New York, New York	25	0				25		
Rochester School for the Deaf, Rochester, New York	225	3	4	165	59	106	4	118
New York School for the Deaf, White Plains, New York	275	9		213	71	143		141
North Carolina School for the Deaf, Morganton, North Carolina	354	0				319	35	
North Dakota School for the Deaf, Devils Lake, North Dakota	132			77	55	73	15	44

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940 (continued)

Institution	Pupils white	Pupils negro	Auricular Training: Full time	Auricular Training: Part time	Auricular Training: Not used	Methods Used: speech	Methods Used: manual	Both (speech and manual combined)
St. Rita's School for the Deaf, Cincinnati, Ohio	87	0			87			87
Ohio State School for the Deaf, Columbus, Ohio	373	0						
Oklahoma School for the Deaf, Sulphur, Oklahoma	355	0			355	90	90	175
Oregon State School for the Deaf, Salem, Oregon	139	0	87	41	11	128	11	
Archbishop Ryan Memorial Institute for Deaf-Mutes, Philadelphia, Pennsylvania	34	0		34		34		
Pennsylvania School for the Deaf, (Mt. Airy) Philadelphia, Pennsylvania	515	22	167	22	348	537		

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940 (continued)

Institution	Pupils white	Pupils negro	Auricular Training: Full time	Auricular Training: Part time	Auricular Training: Not used	Methods Used: speech	Methods Used: manual	Methods Used: Both (speech and manual combined)
De Paul Institute for the Deaf, Pittsburg, Pennsylvania	288	16	24	200	80	280	24	
Western Pennsylvania School for the Deaf, Pittsburg, Pennsylvania	187	4	19	142	30	191		
Rhode Island School for the Deaf, Providence, Rhode Island	112	5	38	79		117		
South Carolina School for the Deaf, Cedar Springs, South Carolina	157	27				116	68	
South Dakota School for the Deaf, Sioux Falls, South Dakota	103	0	8	20	75	48	10	45
Tennessee School for the Deaf, Knoxville, Tennessee	265	32		149	148	206	47	44
Texas School for the Deaf, Austin, Texas	471	0	60	100	311	350	121	

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940 (continued)

Institution	Pupils white	Pupils negro	Auricular Training: Full time	Auricular Training: Part time	Auricular Training: Not used	Methods Used: speech	Methods Used: manual	Both (speech and manual combined)
Utah School for the Deaf, Ogden, Utah	137	0						
Austine School Bratteleboro, Vermont	58	0		58		58		
Virginia School for the Deaf, Staunton, Virginia	210	0	45	105	60			
Washington School for the Deaf, Vancouver, Washington	148	1		88	61	88	40	21
West Virginia School for the Deaf, Romney, West Virginia	275	0	50	25	200	146		129
Wisconsin School for the Deaf, Delavan, Wisconsin	231	1		183	49		49	183
St. John's School for the Deaf, St. Francis, Wisconsin	62	0		62				62

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1939-1940 (continued)[1]

Institution	Pupils white	Pupils negro	Auricular Training: Full time	Auricular Training: Part time	Auricular Training: Not used	Methods Used: speech	Methods Used: manual	Both (speech and manual combined)
Territorial School for the Deaf, Honolulu, Hawaii	81	0		81		67		14
St. Gabriel School for the Deaf, Santurce, Puerto Rico	45	16	20	30	11	61		

1 Statistics of Special Schools and Classes for Exceptional Children, Vol. II, Chapter V. Biennial Survey of Education in the United States, 1938-1940. (Washington, D.C.: United States Department of Education, 1942), pp. 143-151.

APPENDIX C

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1951-1952

(State) School	Auricular Training: Full time	Part time	Not Used	Methods Used: speech	Manual	Both (speech and manual combined)	Hearing combined with lip reading
Alabama School for the Deaf, Talladega, Alabama		one hour				x	one class only
Arizona School for the Deaf, Tucson, Arizona	with some		with some	with most		some	yes
Arkansas School for the Deaf, Little Rock, Arkansas	4½ hours	two hours				x	yes
California School for the Deaf, Berkeley, California	with some	with some	with some	with some	with some	with some	yes, with some
Colorado School for the Deaf, Colorado Springs, Colorado	varies						yes
Georgia School for the Deaf, Cave Springs, Georgia	4 classes	x				x	yes

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1951-1952 (continued)

(State) School	Auricular Training: Full time	Part time	Not Used	Methods Used: speech	manual	Both (speech and manual combined)	Hearing combined with lip reading
Idaho School for the Deaf, Gooding, Idaho		one hour				x	yes, with some
Illinois School for the Deaf, Jacksonville, Illinois	acoustic 50% div.	oral div.	manual div.			x	yes, with some
Iowa School for the Deaf, Council Bluffs, Iowa	1-5 hours 50%	25%		75%	10%	15%	yes
Kansas School for the Deaf, Olathe, Kansas	4½ hours	two hours				x	yes
Kentucky School for the Deaf, Danville, Kentucky		x				x	no
Louisiana School for the Deaf, Baton Rouge, Louisiana	4½ hours	x					yes, with some
Maine School for the Deaf, Portland, Maine	varies	x		x			yes, with some

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1951-1952 (continued)

(State) School	Auricular Training: Full time	Part time	Not used	Methods Used: speech	manual	Both (speech and manual combined)	Hearing combined with lip reading
Maryland State School for the Deaf, Frederick, Maryland		x				x	yes
Minnesota School for the Deaf, Faribault, Minnesota		varies		grades 1-6		grades 7-12	yes
Mississippi School for the Deaf, Jackson, Mississippi		one hour				x	yes
Missouri School for the Deaf, Fulton, Missouri	some older	some younger					yes
Nebraska School for the Deaf, Omaha, Nebraska	grades 1-4	some	one class--manual slow	85%	15%		yes, at times
New Jersey School for the Deaf, West Trenton, New Jersey	some five hours	varies		x			yes

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1951-1952 (continued)

(State) School	Auricular Training: Full time	Part time	Not used	Methods used: speech	manual	Both (speech and manual combined)	Hearing combined with lip reading
New Mexico School for the Deaf, Santa Fe, New Mexico	varies	x	x	x	x	x	yes, with some
North Carolina School for the Deaf, Morganton, North Carolina		five hours		320 pupils		90 pupils	yes
North Dakota School for the Deaf, Devils Lake, North Dakota		varies		primary and intermed. depts.		advanced depts.	primary and intermediate, yes
Ohio School for the Deaf, Columbus, Ohio	some	some				x	yes
Oregon State School for the Deaf, Salem, Oregon	some 5 hr.	varies	some	most	few	some	yes, with some
Rhode Island School for the Deaf, Providence, Rhode Island	available all times	x		x			

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1951-1952 (continued)

(State) School	Auricular Training: Full time	Part time	Not used	Methods used: speech	manual	Both (speech and manual combined)	Hearing combined with lip reading
South Carolina School for the Deaf, Spartanburg, South Carolina		varies				x	yes, with some
South Dakota School for the Deaf, Sioux Falls, South Dakota		varies		academic		vocational	yes, with some
Tennessee School for the Deaf, Knoxville, Tennessee	some all day	varies				x	yes
Texas School for the Deaf, Austin, Texas	x					x	yes
Utah School for the Deaf, Ogden, Utah	varies	x		x			yes

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1951-1952 (continued)

(State) School	Auricular Training: Full time	Part time	Not used	Methods used: speech	manual	Both (speech and manual combined	Hearing combined with lip reading
Washington State School for the Deaf, Vancouver, Washington	100 pupils	50 pupils	53 pupils	90%		10%	yes, with some
West Virginia School for the Deaf, Romney, West Virginia		x					
Wisconsin School for the Deaf, Delavan, Wisconsin	some	restricted hearing				x	yes

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1951-1952

(private) School	Auricular Training: Full time	Part time	Not used	Methods used: speech	manual	Both (speech and manual combined)	Hearing combined with lip reading
Archbishop Ryan Memorial Institute, Philadelphia, Pennsylvania	5 hrs. except in kinder-garten	Kinder.		X			yes
Austine School, Brattleboro, Vermont		up to three hours		X			yes
Beverly School for the Deaf, Beverly, Massachusetts	older	pre-school pupils		X			yes
Clarke School for the Deaf, Northampton, Massachusetts	X			X			yes
Evangelical Lutheran Institute for the Deaf, Detroit, Michigan		five hours		X			yes

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1951-1952 (continued)

(private) School	Auricular Training: Full time	Part time	Not used	Methods used: speech	manual	Both (speech and manual combined)	Hearing combined with lip reading
John Tracy Clinic, Los Angeles, California	some	some		X			yes
Lexington School for the Deaf, New York City, New York	some	some		X			yes
Mystic Oral School, Mystic, Connecticut	4-5 hours	X	X	X			yes
School for Listening Eyes, Wichita Falls, Texas	4½ hours			X			yes
Sherman, K. Smith School of Speech and Oral Education, Tampa, Florida	some	some	some	X			no

EDUCATIONAL DATA, SCHOOLS FOR THE DEAF, 1951-1952 (continued)[2]

(private) School	Auricular Training: Full time	Part time	Not used	Methods used: speech	manual	Both (speech and manual combined)	Hearing combined with lip reading
St. Gabriel School for the Deaf, Santurce, Puerto Rico		3 pupils have indiv. aids	X	X			yes
St. Mary's School for the Deaf, Buffalo, New York	90% pupils	varies		X			yes, with most
St. Rita's School for the Deaf, Cincinnati, Ohio	some indiv. aids	3½ hours group aids		first five years		upper grades and high school	yes
Whitehurst Hearing Rehabilitation Center, New York City, New York	X			X			yes
Wright Oral School New York City, New York	9-3 P.M.			X			yes

[2] Results of questionnaire sent out by investigator.

APPENDIX D

SUMMARY OF SERVICES ACCORDING TO DEGREE OF HEARING LOSS[1]

Hearing Loss in Decibels as Measured by Speech Reception Intelligibility-Threshold

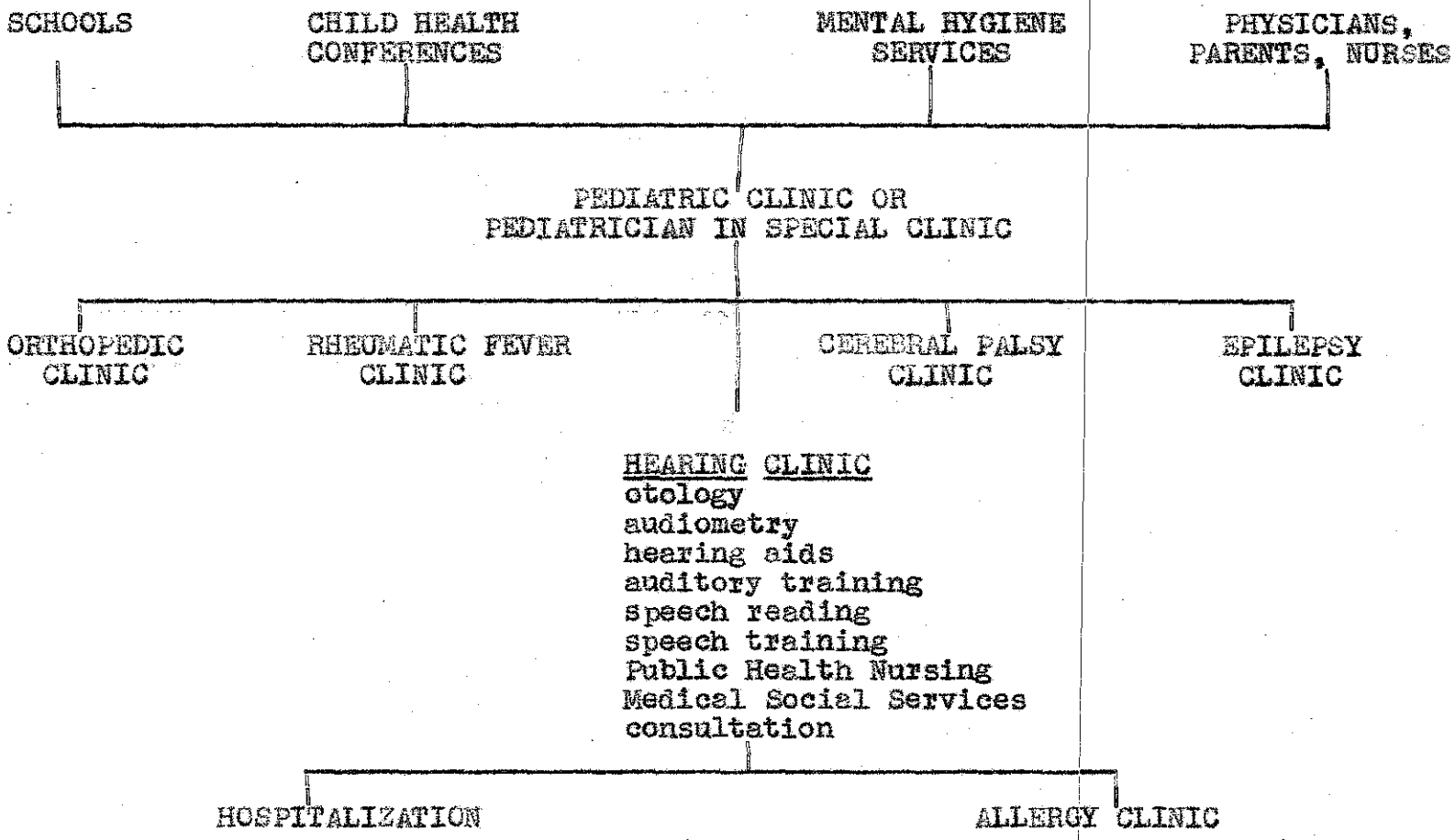
Group in decibels	15 to 25	25 to 35	35 to 50	50 to 70	70 to 85 -plus
	A	B	C	D	E	F
Extent of disability	Submarginal	Marginal	Moderate	Severe	Profound	Profound
Medico-audiologic clinical services indicated	Yes	Yes	Yes	Yes	Yes	Yes
Prognosis from medical treatment (exclusive of nature of and extent of nerve-involvement)	Excellent; normalcy	Excellent; normalcy	Good; moderate hearing	Probably improvement; control of progressive	Perhaps slight improvement in threshold; almost certain arresting of progressive symptoms	Preservation of residual hearing
Rehabilitation indicated: Type and nature of procedures	Usually no problem for children over age 9, nor for adults		Hearing aid fitted	Hearing aid fitted	Hearing aid fitted	Hearing aid fitted if possible
	Pre-primary school group--special attention to language development	Mastery of speech reading	Speech reading	Speech reading	Speech reading	Mastery of speech reading
	Primary school group special seating; special language training	Auditory training of residual hearing indicated	Auditory training of residual hearing with hearing aid	Auditory training of residual hearing with hearing aid	Auditory training of residual hearing with hearing aid	Intensive work in acoustic conditioning
		Speech training	Speech training as indicated Regular school	Speech training as indicated	Speech training as indicated	Speech training
	Public Health Nursing	Public Health Nursing	Public Health Nursing	Public Health Nursing	Public Health Nursing	Public Health Nursing
			Medical Social Service	Medical Social Service	Medical Social Service	Medical Social Service
			Psychotherapy as indicated	Psychotherapy as indicated	Psychotherapy as indicated	Psychotherapy as indicated
				Special acoustic training for primary and pre-primary school groups	Special acoustic training for primary and pre-primary school groups	
				Regular schools unless contraindicated	Special education	Special education
						No dependence on manual signs
						Failure in use of hearing aid must not be assumed until all efforts to establish some useful sound-patterns have been exhausted
Prognosis from hearing rehabilitation	Elimination of disability	Reduction of disability to negligible state	Reduction of disability to marginal state; aided hearing in normal or low normal range	Aided hearing within marginal range; good psycho-social adjustment	Aided hearing within moderate-loss range; psycho-social adjustment depends upon mastery of communicative skills	Handicapped individual; nature and extent of handicap depends upon time of onset and duration of loss of behavioral pattern; and success of re-educative measures
Follow-up indicated	Yes	Yes	Yes	Yes	Yes	Yes
Vocational rehabilitation indicated	No	No	Depends on vocational aptitudes and choice	Yes	Yes	Yes

[1] This summary prepared by William G. Hardy, Ph.D., Director, Hearing and Speech Center, The Johns Hopkins Hospital, Baltimore, Maryland, and modified slightly for use in this publication.

Note: Children's Bureau Publication No. 334, Washington; D.C.: Federal Security Agency.

APPENDIX E

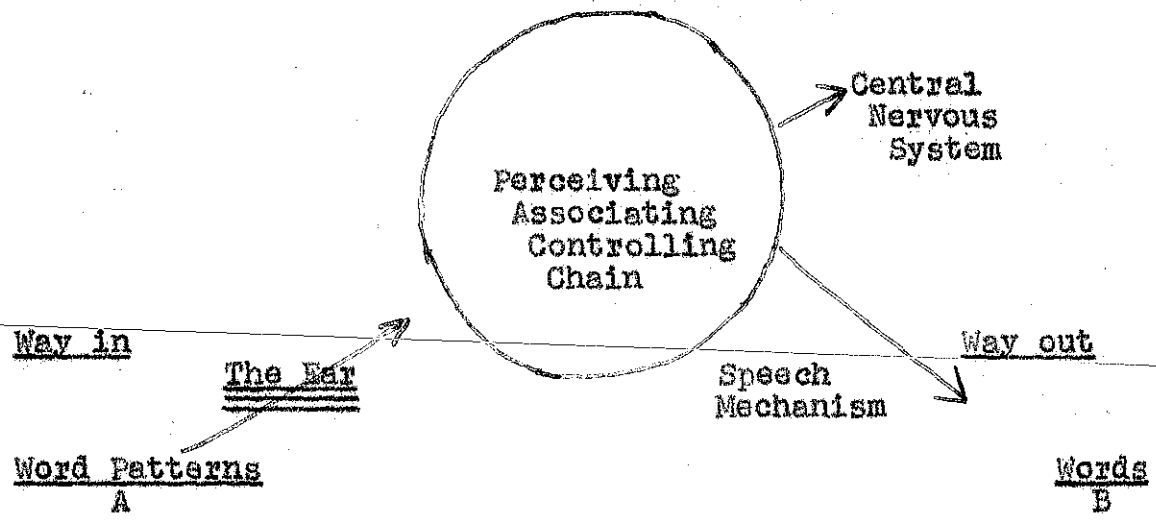
FLOW CHART OF HEARING AND RELATED SERVICES



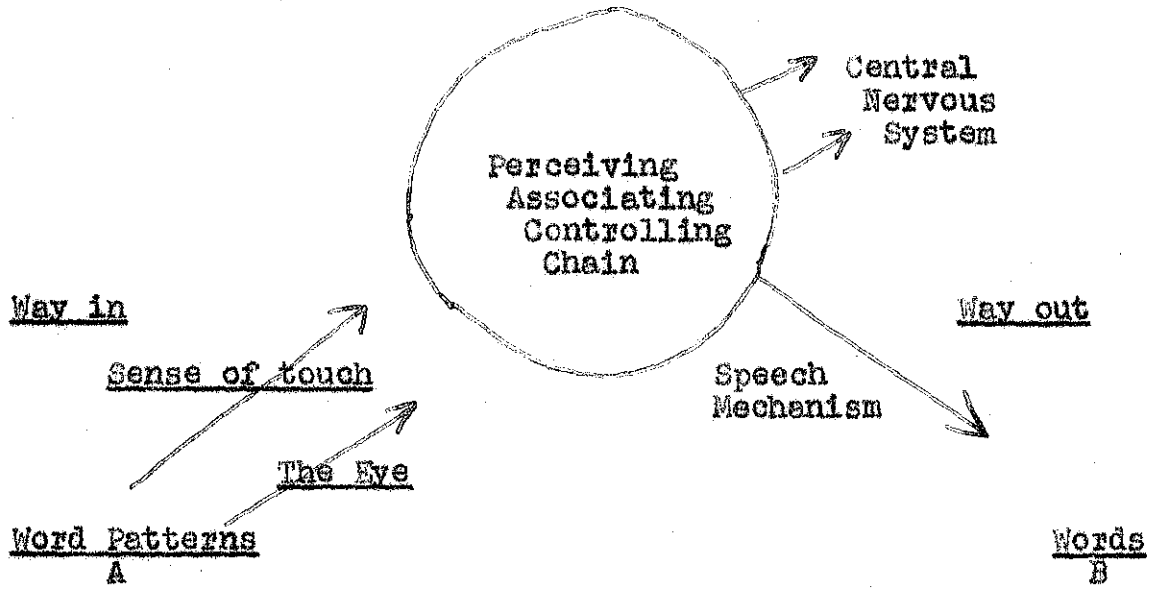
Note: These are some examples of the kind of clinics that State Departments of Health and Crippled Children's Agencies have been developing. (Children's Bureau Publication No. 334, Federal Security Agency, Washington, D.C., p. 18).

APPENDIX F

NORMAL SPEECH DEVELOPMENT[1]



SPEECH DEVELOPMENT IN A CHILD BORN TOTALLY DEAF



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[1] Irene R., and A. W. G. Ewing, The Handicap of Deafness (London: Longmans, Green and Co., 1938), p. 213.