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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

# COMPARATIVE ASSOCIATIVE LEARNING RATES OF HEARING AND HEARING-IMPAIRED STUDENTS OF NORMAL INTELLIGENCE

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COMPARATIVE ASSOCIATIVE LEARNING RATES OF

HEARING AND HEARING-IMPAIRED STUDENTS

OF NORMAL INTELLIGENCE

APPROVED BY

Charlyce King

R E Bagland

Lydia L Williams

Jane Singleton

DISSERTATION COMMITTEE

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## CHAPTER I

## INTRODUCTION

An individual will use his or her five senses of tactile, gustatory, olfactory, vision, and audition in a unique integrated manner to learn from his environment. If one of these senses is non-functioning or only partly functioning due to accident, disease or genetic malformation, the individual must rely on his remaining senses to function in his or her environment.

The hearing-impaired individual, more universally known as the deaf, has been with man throughout the ages. The Bible even calls attention to the deaf. Leviticus 19:14 states:

> Thou shalt not curse the deaf,
> Nor put a stumblingblock before the blind,
> but shalt fear thy God.

Throughout the ages, it has been thought that the deaf were to be classified as mentally defective because of lack of verbal or oral language. Aristotle (355 B.C.)

discussed the phenomenon in his "History of Animals," in these words:

> Viviparous quadrupeds utter vocal sounds of different kinds, but they have no power of converse. In fact, this power, or language, is peculiar to man. For while the capability of talking implied the capability of uttering sounds, the converse does not hold good. Men that are deaf are in all cases also dumb; that is, they can make vocal sounds, but they cannot speak.

The term deaf and dumb followed the deaf or hearing-impaired throughout the ages, leaving the stigma that these individuals, because of no oral language, were mentally retarded.

The education of the deaf has progressed steadily to the point where these individuals are receiving advanced degrees in some colleges and universities and are functioning in our society as well as their hearing counterparts. But, the stigma still remains that they are "deaf and dumb."

## Related Literature

Intelligence has been studied extensively in the mentally handicapped, normal and gifted individuals by such people as Binet, Terman, Thurstone, Piaget and Wechsler.

Physical development, which has also been studied extensively, seems to correlate with mental development. Myklebust (1960) found that there was no difference between deaf and hearing children in ages of sitting and walking. However, Macmillan and Bruner (1906) found differences in some aspects of the physical development of normal and deaf children.

Gradually, attention was given to possible relation-

ships between sensory deprivation and mental or intellectual capacities. Pintner (1946) first indicated that such a relationship existed in the deaf. However, these early works involved quantitative comparisons with the normal to see if sensory deprivation had an influence on intelligence.

Many researchers emphasized the importance of stimulation and experience in the mental development of children with normal sensory capacities. Piaget (1950) has stressed the significance of hearing, vision, and symbolizing as the foundations of intelligence. The child born deaf or having become deafened before acquiring language would lack auditory experiences and the capacity for verbal symbolism.

According to Myklebust (1966 p. 60):

> If mental development varies mainly as a reciprocal of the limitation in language acquisition, it follows that if the language limitation can be alleviated, more normal development of mental capacities will ensue.

It seems that a common concern about the deaf is that they are retarded or intellectually inferior because of the lack of language or the lack of language stimulation as an infant.

The very young infant probably does not respond to the verbal meanings that the mother gives him but more to the tone of the voice, facial expressions, body movement and tactile stimulation. Mindel and Vernon (1971, p. 62) point out in their book that although in our society verbal speech is the most prevalent, it is not our only means of communication. Other modes of communication incorporate facial

expressions, hand and body movements. A smile that accompanies "I like you," is a very simple example of this.

"The deaf child is more likely to attend to nonverbal components of communication" (Mendel and Vernon, 1971, p. 63). Mendel and Vernon (1971) further contend that the deaf individual would learn that manual signs have meanings in the same way that a hearing individual learns that an oral vocalization of a sound or combination of sounds have meaning. The deaf have language, but it is not always an oral language but a combination of manual signs that have meanings, just as oral vocalizations have meanings to the hearing. The deaf will also use more "body language" than will a hearing individual.

In Klausmier's and Ripple's book (1971, p. 196) they refer to the concept that there is a relationship between intelligence and learning abilities. This is a simple concept that educators have known for many years. A person with an I. Q. of 150 usually learns at a faster rate than a person with an I. Q. of 50.

The deaf for many years were considered mentally retarded because of their inability to communicate orally. The deaf individuals were given intelligence tests that were primarily verbal tests, and these tests were not valid indicators of intelligence. As Mendel and Vernon (1971, p. 87) state in their book they include data tables to support their view. (pages 88-90):

> Now with proper intelligence tests it has been conclusively demonstrated by over fifty independent studies that deaf and hard of hearing people have essentially the same distribution of intelligence as the general population. All the available evidence demonstrates that there is no direct relationship between hearing loss and intelligence.

Studies cited by Mendel and Vernon (1971, pp. 88-90) which incorporated Florence Goodenoughe's Draw-a-Man (D.A.M.) test with the deaf and hearing impaired included: Shirley and Goodenough in 1932 with 406 deaf, six to 14 year old students with the median I. Q. of 87.7; Springer, in 1938 with 330 deaf, six to 12 year old students, with an I. Q. distribution the same as normals; Glowatsky in 1953, with 24 deaf and hard of hearing, 7.5 to 15.7 year old students with a mean I. Q. of 98.46; and Vernon in 1957, with 97 deaf children having a mean I. Q. of 90. These studies conclude that the D.A.M. is an accurate indicator of the intelligence of deaf and hearing-impaired individuals.

Reading achievement of the deaf has been studied by many people as reported by Kirk (1972, p. 280): these individuals include Pugh, Gentile, Moores, Odom Blanton and Nunally. Their studies indicated the deaf and hearing-impaired are retarded in reading abilities as compared with their hearing counterparts.

Results of academic achievement tests administered to approximately 19,000 hearing-impaired children enrolled in 290 different special education programs in the 1970-71 school year, have been reported by the Office of Demographic

studies, Galludet College (1972).

These findings indicate that the hearing-impaired show serious retardation in overall educational achievement.

As Mendel and Vernon (1971, pp. 87, 94) discuss in their book ". . . the average deaf adult is undereducated." "This is a clear indictment of educational systems which have failed to develop the intellectual potential of the average deaf person."

Dunn (1973, p. 379) observes how the hearing-impaired are now being detected earlier and given infant and preschool education. This would possibly result in bringing the hearing impaired up to academic normalcy with those hearing-impaired being born today.

The cognitive abilities of the deaf and hearing impaired have been studied to determine if degrees of hearing loss had any significance. In a study by Fiedler (1957) using a total of 49 children with different degrees of hearing loss, it was found that there was no significant difference between the good and poor learners in either etiology of deafness or degree of hearing loss.

Rosentein's (1960) study of cognitive abilities of deaf and hearing students utilized 120 Ss (60 deaf, 60 hearing) ranging in ages from eight to 12 years old. Rosentein used a modified Apparatus Learning Rational which is a visual learning device. His results indicated no statistically significant difference between deaf and hearing children in

their ability to perceive, abstract, or generalize; nor, were there any differences observed when the groups were compared with respect to age. In Furth's (1964) study of the literature of language and cognition in the deaf, he concluded that "Deaf were found to perform similarly to hearing persons on tasks where verbal knowledge could have been assumed aprior to benefit the hearing."

In a study by Stark (1972) using a problem solving task utilizing 44 hard-of-hearing children of average intelligence with ages ranging from 6.9 to 12.11 years, he found that there was a statistically significant difference between the problem solving abilities of these students at the 0.05 level of significance with the hearing subjects performing better.

Different investigators have compared the performance of hearing and deaf individuals on different types of learning tasks and then rationalized their findings in terms of various theoretical notions. Blair (1957) observed that deaf children on the digit span were inferior to hearing, and thought that these tasks involved "relatively abstract type of mental operations." However, Goldstein (1939) considered the deaf childs' superiority in some tasks as being a result of a "psychological compensatory phenomenon by which the deaf child becomes visually organized." Hiskey (1956) noticed that deaf children were consistently inferior to hearing children in immediate recall and suggested that the hearing child

had a decided advantage where vocalization aided retention.

In Furth's study (1961) he cites Naffin as summarizing German research which gave evidence that marked superiority of the deaf child's visual memory in certain situations was characterized by a simplicity that required little or no language to be meaningfully perceived.

Doehring (1960) limited his research to visual spatial memory and used a task specially designed for this aspect of memory. He found the performance of deaf children was in every respect similar to that of hearing children. Furth (1961) used another basic aspect of visual memory, the perception and visual memory of simple color. He utilized a paired-associates task involving four simple colors and two toy animals, and found no differences between deaf and hearing at the seven to 10 year old level. However, a difference in favor of the hearing in the 11 and 12 year old age group did appear. This difference was attributed to a rapid improvement in the hearing not matched by the deaf. Furth states "The deaf childrens' relative inferiority was thought to be due to a lack of experience and training."

Griswold and Commings (1974) conducted a study of preschool age (1.5 years to 5.0 years) deaf children to determine if out of 493 different words how many would be in the expressive vocabulary of the children. The words used in this study that are also included in the Hiner 16-Picture Paired Associate Learning Task, and it should be noted by

this author that all but one word (comb) was known by at least 40 percent of the sample while most of the words (seventeen) were known by 100 percent of the sample. The word comb was known by only 17 percent of the preschool deaf children in this study.

## Associative Learning

Associative learning, as explained by Hall and Lindzey (1957, p. .540) is the "spatial and temporal linking of two events, usually accomplished by using paired-associate material. Such material may consist of a series of paired items in which one serves as a stimulus and the other a response. Paired-associate learning is learning to respond with the second item of a pair when the first is presented."

Jung (1968, p. 45) states that associative learning refers to the correct pairing of stimuli and responses. He cited an everyday situation analogous to paired-associate learning as the acquisition of a foreign language vocabulary (p. 43). Learning of an association between the two members of one pair is somewhat independent of the associations to be formed for other pairs.

The literature contains experiments relating to the use of paired-associate learning tasks with different ethnic backgrounds. Cole (1971) compared Indians and Whites; Prickett (1970) compared Black and White students. Other studies compared Mexican-American and Anglo-American; retarded and normal children; Blacks of both low-and middle-class; and

White children of both low-and high-socioeconomic status.

In 1962, Hiner attempted to compare the associate learning rates of bright, normal, and retarded children. For this, she developed a set of pictures which she copyrighted as the Picture Paired Associate Learning Task. It is composed of 16 pairs of pictures.

Hiner chose pictures rather than words for the paired associate task to avoid:

> (1) subject variation in the amount of time needed to recognize words; (2) the variation in reading ability among school children; (3) certain words that might arouse sufficient affect, thus inhibiting the learning process; (4) tasks that might arouse negative feelings if the subject had had unpleasant experiences in reading; and (5) words of one or more than one syllable in the same list that might present a variable in the difficulty of the learning lists (p. 11).

Criteria for the pictures included:

> (1) the pictures must be simple outline drawings of common objects; (2) the words represented by the pictures must be one-syllable nouns; (3) the pictures must be readily and immediately recognizable; (4) the pictures must be readily and consistently identifiable, that is, if a picture of a horse was sometimes called "pony" and sometimes "horse" the picture was eliminated; and (5) pictures must not be obviously potentially affect arousing, for example, a picture of a gun or of a snake. In order to insure immediate recognition and consistent identification, the pictures were shown to groups of 75 kindergarten children and to 40 fourth-grade children. Pictures which did not meet the above criteria were eliminated (pp. 11-12).

Rohwer (1968) conducted a study to determine the reliability of a paired-associate task when used as a test of learning proficiency, and to assess the relationship between performance on such a task and on I. Q. tests as a function of grade level and socioeconomic status. His subjects

represented kindergarten, first, and third grade students of both high and low socioeconomic status. He concluded that the reliability of the paired-associate task was acceptably high.

Although a paired-associate learning task seems to involve rote learning processes, Rohwer cited research demonstrations that efficient performance on paired-associate task activities decidedly was not rote in nature. If the subject created images to link the items of a pair, or if he formulated sentences that relate the items to one another, his performance improved markedly. Rohwer also referred to studies indicating that performance on paired-associate tasks correlates substantially with long-term school learning as measured by grades or by scores on achievement tests.

In studies of the hearing impaired, Furth (1961) compared the visual paired-associates task with deaf and hearing children. His study compared 360 subjects (180 deaf, 180 hearing) divided into six age groups (seven, eight, nine, 10, 11, 12 year olds). He found that no significant differences except at the 11 and 12 year old levels.

Campbell (1963) compared hearing and hearing impaired on a paired-associative learning task using semi-concrete and abstract materials. This study utilized 18 hard of hearing and 18 hearing subjects ranging in age from 8.7 years to 12.7 years of age. The results of this study found there was a significant difference in the learning rates between the

hard of hearing and hearing subjects with the hearing group performing better.

## CHAPTER II

## STATEMENT OF THE PROBLEM

Do hearing impaired children of normal intelligence learn the 16 picture Paired Associate Learning Task with fewer trials and/or errors as a group than do hearing children of normal intelligence?

Two null hypotheses, one relative to trials-to-criterion scores, and one relative to error scores, were tested for statistical significance.

$H_{01}$: There will be no statistically significant difference in the number of trials needed by subjects of the hearing and hearing impaired groups in learning the 16-picture Paired Associate Learning Task.

$H_{02}$: There will be no statistically significant difference in the number of errors made by subjects of the hearing and hearing impaired groups in learning the 16-picture Paired Associate Learning Task.

The level of statistical significance required to support the hypotheses was set at 0.05.

### Operational Definitions

Hearing impaired: a hearing loss of sufficient degree that

leaves the individual incapable of understanding oral language or developing oral communications unless specially trained.

Hearing: ability to understand spoken language by the use of the auditory mechanisms.

Learning: a relatively permanent change in behavior brought about by reinforced practice.

Associative learning: the spatial and temporal linking of two events.

Paired-Associate Material: material used in learning, consisting of pairs of items in which one item serves as a stimulus and the other as a response.

Stimulus Item: the first of two items presented to a subject in paired-associate material.

Response Item: the second of two items of a pair in paired-associate material. It is the response desired from the subject who has been presented the first item, the stimulus item.

Paired Associate Learning: learning to respond with the second item of a pair when the first item of paired associate material is presented.

Student Error: the result of the subject's failure to respond to a stimulus item within five seconds after presentation, or an incorrect response to a stimulus.

Student Trial: the result of the presentation and responses for all 16 pairs of the 16-picture Paired Associate

Learning Task was considered as one trial regardless of the number of errors committed during that one complete presentation.

Trials to Criterion: the total number of trials required by a subject to achieve two successive correct repetitions of the 16-picture Paired Associate Learning Task.

Errors to Criterion: the total of all recorded errors of the subject during all the trials necessary to achieve the two successive correct repetitions of the 16-picture Paired Associate Learning Task.

Normal Intelligence: a resultant intelligence quotient (I. Q.) within the 80-120 range as measured by the Koppitz Human Figure Drawing Test.

## Major Assumptions

In consideration of this study, the following assumptions were made:

1. Associative learning is a legitimate area of study.
2. Associative learning can be measured.
3. Associative learning can be measured with the Hiner 16-picture Paired Associate Learning Task as the test instrument.
4. The Hiner 16-picture Paired Associate Learning Task is an adequate instrument for measuring associative learning.
5. The range of intelligence selected is a legitimate category.

6. Intelligence can be measured with the Koppitz Human Figure Drawing Test being administered to fourth, fifth, and sixth grade hearing and hearing impaired students.
7. The sample of students may be considered of adequate size from which to generalize.
8. The hearing impaired students will not be at a disadvantage in understanding instructions given them orally and manually.
9. The pictures on the Hiner 16-picture Paired Associate Learning Task is within the receptive and expressive vocabulary of the hearing and hearing impaired subjects.

# CHAPTER III

# METHODS AND PROCEDURE

## The Subjects

Subjects participating in this study included sixty fourth, fifth, and sixth grade boys and girls, within an I. Q. range of 80-120. Half of them were selected from Davis Elementary School, Davis, Oklahoma. The other half was selected from Oklahoma School for the Deaf (O.S.D.) Sulphur, Oklahoma.

## Pre-experimental Procedure

A total of 160 fourth, fifth, and sixth grade students were administered the Koppitz Human Figure Drawing Test, (H.F.D.).

The Human Figure Drawing Test was selected for this study because it could be administered as a group test to measure general mental ability. Included in the study were 60 students whose I. Q. fell within the range of 80-120.

The testing of over half the fourth, fifth, and sixth grade population, 120 children, at Davis Elementary School was conducted by the author during the spring of 1975. The author administered the same test to 40 boys and girls at the

Oklahoma School for the Deaf. This included students enrolled in normal classrooms, e.g. classrooms where the children were to be of normal or above normal intelligence and in which no other disability was exhibited or known other than hearing impairment.

Of the 120 hearing students at Davis Elementary School those students whose scores fell above or below the stated range were eliminated; seven fell below, and four exceeded the range. Of the remaining 109 students, 30 were selected to be subjects. From the 40 in the hearing impaired group two were eliminated because of scores falling below the slated range. Of the 38 remaining, 30 were selected as subjects. In each case subjects which met the criteria (109 hearing, 38 hearing impaired) were selected randomly. This was done by selecting 30 of the score sheets which had been placed face down on a table before the author.

A list of all 34 words that would need to be in the hearing impaired subjects receptive and expressive vocabulary to identify the pictures on the Paired Associate Learning Task was given to all teachers (four) of the hearing impaired subjects. In all cases the four teachers stated that each and every child in his or her class knew these words receptively and could use them expressively.

## Testing Procedure

The test instrument used for this study was the Hiner 16-picture Paired Associate Learning Task. This test consists

of two, five-by-eight inch spiral-bound booklets. Booklet One, the Stimulus Set, contained 16 pairs, one pair to a page, of outline pictures of common objects: cat-bed (the sample pair), frog-broom, glass-dog, tent-brush, car-fork, fox-pig, chair-dress, leaf-house, comb-drum, hat-cup, bird-lamp, duck-saw, coat-sun, kite-fish, tree-shoe, bread-clock, and skate-ring. Booklet Two contained only the first picture of the Stimulus Set. Each subject was tested individually in a room of the school away from general activity, thus eliminating all possible distractions. The examiner, who was the author in all instances, asked the child to sit at the end of a table at a right angle to the examiners left.

For each subject, instructions were given orally for the hearing, and orally and in sign language for the hearing impaired. The instructions were given as follows:

> Here are some cards (the examiner opens Booklet One). Each card in this set has two pictures on it (the examiner shows the subject the sample pair). Look at both pictures carefully and try to remember which two pictures go together. (The examiner then closes Booklet One and shows the subject Booklet Two). Then I will show you another set of cards like these with only the first picture showing (the examiner shows the sample card). I want you to tell me what picture went with this picture. (The examiner pauses for the answer.) So, as you see the two pictures together, try to remember what two pictures went together. Do you understand what you are to do?

If the subject failed to make the correct response for the sample cards, the examiner restated the instructions. Only once, for a hearing impaired subject was this necessary.

Following the explanation and sample trial, the

paired pictures were presented to the subject at the rate of one every three seconds. Booklet One was then closed, and the single pictures within Booklet Two were presented at the rate of one every five seconds. The examiner recorded each oral or manual response made by the subject. If no response was made during the five seconds, it was recorded as an incorrect response.

Additional trials were administered until the subject reached the criterion of two successive correct repetitions of the list. Intertrial intervals were 10 seconds in length. Between trials, the examiner said orally or manually, "Now we will look at the pictures again. Try to remember what two pictures were together."

If the subject questioned the examiner about the trials, the examiner added, "We will keep looking at the pairs of pictures until you learn all of them."

All testing, both the Koppitz Human Figure Drawing Test and the Paired Associate Learning Task, was completed within a period of two weeks.

# CHAPTER IV

## RESULTS

In this study, 30 fourth, fifth and sixth grade hearing and 30 fourth, fifth and sixth grade hearing impaired children were tested in an effort to compare the rate of learning of the two groups. The test instrument used was the Hiner 16-picture Paired Associate Learning Task. The criterion of learning of this test is two successive correct repetitions of the list. Comparisons were made on the number of trials required to meet the criterion of learning and on the number of errors committed in reaching this criterion. The required level for statistical significance was set at the 0.05 level.

The I. Q. scores of each group ranged from 80-120 as measured by Koppitz Human Figure Drawing Test.

A t-test was used in the statistical analysis of the data to establish whether the variables of performance and hearing were related.

Trial and error scores were based on each subject's performance as recorded on individual record sheets. A subject was assumed to have learned the task when he could successfully repeat (orally or by sign language) the paired

association twice in succession without error. For scoring purposes, if a subject repeated without error, trials four and five, for example, he was given a trial score of four. An error score was recorded when a subject failed to give a correct response to the stimulus presented or if he failed to make any response within five seconds following the presentation of the stimulus.

## Analysis of Trials in the Learning Task

The group of hearing impaired subjects completed the task with a total of 247 trials, while the total number of trials required by the hearing subjects was 157.

Relative to trials, the hypothesis stated that there would be no statistically significant relationship between the number of trials to criterion made by hearing and hearing impaired subjects. The number of trials required by each subject in both groups was arranged in a distribution and a mean and standard deviation computed for each group. The results are presented in Table 1.

The t-test score (3.90) showed that there was a statistically significant difference between the two groups at the .001 level of confidence. The results therefore allow the rejection of the null hypothesis of no relationship between trials to criterion of the hearing and hearing impaired groups.

TABLE 1

t-SCORE, MEAN, AND STANDARD DEVIATIONS BETWEEN TRIALS-TO-CRITERION OF HEARING AND HEARING IMPAIRED SUBJECTS

| Subjects | N | Mean | Standard Deviation | t-score | df |
|---|---|---|---|---|---|
| hearing | 30 | 5.23333 | 2.344227 | 3.80* | 58 |
| hearing impaired | 30 | 8.23333 | 3.626371 | | |

*significant at the .001 level

## Analysis of Errors in the Learning Tasks

Subjects of the hearing impaired group made a total of 1371 errors while learning the test. A total of 784 errors were committed by the hearing subjects.

Relative to errors, the hypothesis stated that there would be no statistically significant relationship between the number of errors to criterion made by hearing and hearing impaired subjects. The number of errors made by each subject in both groups was arranged in a distribution and a mean and standard deviation was computed for each group. The results are presented in Table 2.

The t-test value was statistically significant. The results will therefore allow the rejection of the null hypothesis of no relationship between the number of errors to criterion of the hearing and hearing impaired groups.

The point on the learning continuum at which the completion of the learning task occurred for each subject of

TABLE 2

t-SCORE, MEAN AND STANDARD DEVIATIONS BETWEEN ERRORS TO CRITERION AND SOCIOECONOMIC STATUS

| Subjects | N | Mean | Standard Deviation | t-score | df |
|---|---|---|---|---|---|
| hearing | 30 | 22.8000 | 18.04923 | 3.9* | 58 |
| hearing impaired | 30 | 45.7000 | 26.952256 | | |

*significant at the .001 level

each group is indicated in Table 3.

The mean number of trials to criterion required by the hearing group was 5.233333. Of the 30 subjects tested, 19 completed the task in fewer than 5.23 trials and 11 completed the task in more than the mean number of trials.

The mean number of trials to criterion required by the hearing impaired group was 8.233333. Within this group, 20 completed the task in fewer than 8.23 trials and 10 required more than the mean number of trials.

The mean number of errors committed by the hearing subjects in reaching the criterion was 22.80000. Of this group, 15 made fewer than 22.8 errors, and 15 committed more than 22.8 errors.

The mean number of errors committed by the hearing impaired subjects in reaching the criterion was 45.70000. Within this group 21 made fewer than 45.7 errors and nine committed more than 45.7 errors.

TABLE 3

THE COMPLETION OF THE LEARNING TASK
TO NUMBER OF TRIALS

| Trial Number | Hearing | Hearing Impaired |
|---|---|---|
| 1 | 1 | |
| 2 | 2 | |
| 3 | 2 | |
| 4 | 7 | 4 |
| 5 | 7 | 2 |
| 6 | 4 | 3 |
| 7 | 2 | 5 |
| 8 | 4 | 6 |
| 9 | | 2 |
| 10 | | 4 |
| 11 | | 1 |
| 12 | | |
| 13 | 1 | |
| 14 | | |
| 15 | | 1 |
| 16 | | 1 |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | 1 |
| Mean | 5.233333 | 8.233333 |
| Standard Deviation | 2.344227 | 3.626371 |
| Range | 12.0 | 16.0 |

# CHAPTER V

## DISCUSSION AND SUMMARY

The learning abilities of the hearing impaired individual has often been debated by researchers. The stigma "deaf and dumb" is still with the hearing impaired today. Although the outcome of this study indicates that as a group they do not learn as fast as their hearing counterparts it does however indicate that some of the hearing impaired do learn at a rate equal to the hearing.

The present investigation was undertaken to ascertain if, on a learning task not predicated on environment or on prior learning, the hearing impaired child would evidence an ability to learn equal or better to that of the hearing child. The learning task used was the Hiner 16-picture Paired Associate Learning Task.

In this study, 60 fourth, fifth, and sixth grade boys and girls, 30 of whom were hearing and 30 hearing impaired, were selected as subjects from a total of 160 children who were administered the Koppitz Human Figure Drawing Test. The I. Q. range for those subjects chosen to participate in the study was set between 80 and 120.

It was hypothesized that in learning, the 16-picture

Paired Associate Learning Task there would be no statistically significant relationship between number of trials to criterion by hearing and hearing impaired subjects. Nor, would there be any statistically significant relationship between errors committed by hearing and hearing impaired subjects. The level of statistical significance required to support the hypotheses was set at 0.05.

The hypothesis relative to the number of required trials was not supported. The results indicated a statistical difference between the number of trials to criterion required by hearing subjects and hearing impaired subjects with the hearing having fewer trials. The mean number of trials by the hearing subjects was 5.23 and the mean number of trials by the hearing impaired subjects was 8.23. The t-test indicated a score of 3.80 on trials to criterion which is a significant statistical difference at the .001 level.

The hypothesis relative to the number of errors that would be committed was not supported. The results indicated a significant difference between errors of hearing and hearing impaired subjects with the hearing having fewer errors. The mean number of errors made by the hearing subjects was 22.8, and the mean number of errors committed by the hearing impaired was 45.7.

In comparing individual number of trials to the mean number of trials, it is observed that the hearing groups whose mean number of trials was 5.23 and 19 subjects who

required fewer than 5.23 trials while 11 subjects required more. The mean number of trials for the hearing impaired group was 8.23 and 20 subjects required fewer trials while 10 required more.

Making the same type of comparisons with the number of errors committed, it is observed that the mean number of errors committed by the hearing group was 22.8, with 15 making fewer than 22.8 errors and 15 making more. The mean number of errors committed by the hearing impaired was 45.70, while 21 made fewer errors and nine subjects made more than the mean number.

The t-test score (3.9) on errors to criterion was a statistically significant difference at the .001 level with the hearing making fewer errors.

The Raw Score tables in the Appendix show that no hearing subject committed more than 89 errors. The next to the highest errors for a hearing subject was 53 which is 36 fewer errors than the highest. The highest number of errors committed by a hearing impaired subject was 119 with the next lowest score being 113 or six fewer errors. The fourth to the highest number of errors was 72 with the next subject having 110 errors or 38 fewer errors than the one preceding it. By using the t-test and dropping the higher scores on the hearing subjects (89) and hearing impaired (110, 113, 119) there is still a statistically significant difference (.02).

The highest number of trials taken in the hearing

group was 13 with the next highest number of trials being eight or a difference of five. The highest number of trials for the hearing impaired group was 20 with 16 being the next highest or a difference of four. By dropping both highest numbers of trials in the hearing and hearing impaired group there is still a statistically significant difference using the t-test, (4.45) (significant difference at .001 level).

It would seem fair to conclude from the results of this study that there is a difference in learning rates between hearing and hearing impaired students, on a paired associate learning task with the hearing subjects performing with fewer trials and errors.

## Implication for Further Research

For a different study, it might be possible to use only males or females in a study and compare them with males or females who are hearing impaired.

Another approach to a research problem would be to compare learning rates of hearing impaired institutionalized children to hearing impaired children enrolled in a public school. One of the problems with undertaking a study of this sort would be finding an adequate sample of public school children.

A large amount of research has shown that parent involvement is important for a child's success in school. The parents of institutionalized hearing impaired children generally have little participation in their child's education.

Further research may be done utilizing institutionalized hearing impaired and hearing children who are in an orphanage.

Another research study may be to compare the learning rates of hearing impaired children and hearing children who have an I. Q. of 120 or more.

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# APPENDIX

TABLE 4

RAW SCORES

Hearing Subjects

| Subject | Trials | Errors |
|---|---|---|
| 1 | 1 | 0 |
| 2 | 2 | 1 |
| 3 | 2 | 9 |
| 4 | 3 | 12 |
| 5 | 3 | 15 |
| 6 | 4 | 5 |
| 7 | 4 | 9 |
| 8 | 4 | 18 |
| 9 | 4 | 21 |
| 10 | 4 | 22 |
| 11 | 4 | 22 |
| 12 | 4 | 23 |
| 13 | 5 | 12 |
| 14 | 5 | 14 |
| 15 | 5 | 22 |
| 16 | 5 | 23 |
| 17 | 5 | 23 |
| 18 | 5 | 28 |
| 19 | 5 | 35 |
| 20 | 6 | 21 |
| 21 | 6 | 35 |
| 22 | 6 | 35 |
| 23 | 6 | 38 |
| 24 | 7 | 34 |
| 25 | 7 | 52 |
| 26 | 8 | 34 |
| 27 | 8 | 36 |
| 28 | 8 | 43 |
| 29 | 8 | 53 |
| 30 | 13 | 89 |
| Mean | 5.23333 | |
| Standard Deviation | 2.344227 | |

TABLE 5

RAW SCORES

Hearing Impaired Subjects

| Subject | Trials | Errors |
|---|---|---|
| 1 | 4 | 16 |
| 2 | 4 | 17 |
| 3 | 4 | 17 |
| 4 | 4 | 23 |
| 5 | 5 | 23 |
| 6 | 5 | 25 |
| 7 | 6 | 35 |
| 8 | 6 | 36 |
| 9 | 6 | 38 |
| 10 | 7 | 20 |
| 11 | 7 | 36 |
| 12 | 7 | 38 |
| 13 | 7 | 44 |
| 14 | 7 | 45 |
| 15 | 8 | 29 |
| 16 | 8 | 38 |
| 17 | 8 | 41 |
| 18 | 8 | 43 |
| 19 | 8 | 46 |
| 20 | 8 | 52 |
| 21 | 9 | 44 |
| 22 | 9 | 50 |
| 23 | 10 | 32 |
| 24 | 10 | 42 |
| 25 | 10 | 64 |
| 26 | 10 | 63 |
| 27 | 11 | 72 |
| 28 | 15 | 110 |
| 29 | 16 | 113 |
| 30 | 20 | 114 |
| Mean | 8.23333 | |
| Standard Deviation | 3.626371 | |