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NAME OF AUTHOR/*NOM DE L'AUTEUR* SONIA HAYWARD

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NAME OF SUPERVISOR/*NOM DU DIRECTEUR DE THÈSE* Dr. G.M. Kysela

DATED/*DATÉ* Jan 21/75 SIGNED/*SIGNÉ* Sonia Hayward

PERMANENT ADDRESS/*RÉSIDENCE FIXÉ* 13 Groveland Road
Sherwood Park
Alberta

NL-91 (3-74)

THE UNIVERSITY OF ALBERTA

A COMPARISON OF DEAF AND HARD OF HEARING CHILDREN ON TWO MEASUREMENTS OF INTELLIGENCE

by

(C) Sonia W. Hayward

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled A Comparison of Deaf and Hard of Hearing Children on Two Measurements of Intelligence, submitted by Sonia W. Hayword in partial fulfilment of the requirements for the degree of Master of Education.

Supervisor

Date: October 3, 1974.

To Mom and Dad

ABSTRACT

The purpose of this study was to assess the verbal and non-verbal abilities of deaf and hard of hearing children to determine if any differential patterns were present. Several comparisons were undertaken to answer this question:

The correlation coefficients obtained by a deaf and hard of hearing sample on a verbal and non-verbal intelligence test were compared.

A hard of hearing sample was compared with a deaf sample on a verbal intelligence test.

The scores obtained by a deaf and hard of hearing sample on a non-verbal intelligence test were compared.

The deaf sample consisted of twenty-five children who attended the Alberta School for the Deaf, Edmonton, Alberta and who ranged in age from 6 years 10 months to 12 years 2 months. The hard of hearing sample included twenty-five children ranging in age from 6 years 5 months to 12 years 3 months who attended the Hearing Conservation Classes at Windsor Park Elementary School, Edmonton, Alberta. Speech reception thresholds were obtained for ninety-two percent of the hard of hearing sample, however no speech reception thresholds were obtainable for the deaf sample. The samples were matched for age (within six months) and sex. Any child known to be retarded, emotionally disturbed, severely cerebral palsied or neurologically impaired was excluded from the study.

Verbal (Peabody Picture Vocabulary Test - Form A - P.P.V.T.) and non-verbal (Queensland Test - Q.T.) intelligence tests were administered to all the students in both samples. A comparison of the results

revealed that no significant difference existed between the correlation coefficients obtained by the deaf versus hard of hearing for the P.P.V.T. and Q.T. The hard of hearing sample did score significantly higher than the deaf sample on the verbal intelligence test (P.P.V.T.) whereas the deaf and hard of hearing samples obtained similar scores on the non-verbal intelligence test (Q.T.). An analysis of the Q.T. subtest scores revealed that the deaf scored higher than the hard of hearing on one subtest (Form Assembly).

These findings suggest that differences in language facility of these two samples may have produced the P.P.V.T. results. Due to their inability to receive speech the children within the deaf sample have not acquired the same language skills (e.g. receptive, vocabulary, etc.) as have the hard of hearing children and this fact has adversely affected their ability to perform on a verbal intelligence test (P.P.V.T.).

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CHAPTER I

INTRODUCTION

Perhaps the most prevalent contemporary view regarding profoundly deaf persons and the way in which language affects their thought processes was outlined by Furth (1966) in his book Thinking Without Language in which he advocated that thought could occur without language and like Piaget (1960) he referred to thought as internal "symbolization". Both Furth and Piaget believed that although there is a close relationship between language and thought, language does not govern thoughts or "form operations" (Furth, 1966). To support this hypothesis Furth (1966) referred to the behavior of groups of individuals who have never developed language as we know it. These individuals are the congenitally profoundly deaf who have never learned to speak and whose language has never developed to include the syntax of a verbal language. Furth proposed that these people are perfectly capable of "thinking" or "forming operations" to solve problems and are consequently "intelligent". It is his premise that although the deaf may perform poorly on verbal tasks they are still able to solve problems or "operate" at a level comparable with their hearing peers. It would seem that, for the deaf, an intelligence test which includes extensive verbal aspects is a poor measure of general cognitive ability. So, although Wechsler (1949) stated that standardized psychological tests of mental ability usually show a high positive correlation between verbal and performance abilities this is probably not so for the hearing impaired individual.

In recent years the use of standardized intelligence tests has increased. They can be valuable instruments when used appropriately in that they supply information which will help to make realistic decisions regarding the placement of children.

Obvious problems arise when hearing impaired individuals are tested on verbal intelligence tests. Unless the test results are interpreted with caution misconceptions will inevitably arise. For example if a deaf child performs poorly on a verbal intelligence test the child may do so because of:

An inability to understand what is expected of him due to a language deficit.

An intellectual inability to perform the task.

An insufficient language facility with which to answer the questions presented.

The problem then exists as to whether the test measures the child's verbal linguistic ability or the child's present language level. The hearing impaired child may be intellectually capable of acquiring the same language level as his peers; often, however, his hearing loss prevents him from doing so. From the hearing impaired child's score on a verbal intelligence test we can say little about the child's verbal linguistic potential or ability and even less about his general intelligence or cognitive ability.

The hearing impaired have been described as being "concrete", "immature" and "sense dominated" as compared with the hearing child based on the type of verbal responses they make on verbal intelligence tests (Myklebust, 1960). This may be true, however it could be that the hearing impaired child's language deficit makes him <u>appear</u> "concrete", "immature" and "sense dominated".

It is important that psychologists and educators be aware of the limitations of verbal intelligence tests when applied to a hearing impaired population to enable them to give more realistic interpretations of the tests being used. Testing a hearing impaired child on a verbal intelligence test can be valuable diagnostically, however, care must be exhibited when conclusions are drawn from the results obtained. The purpose of this study is to compare the scores obtained by two closely related samples of hearing impaired children (deaf and hard of hearing) on a verbal intelligence test (Peabody Picture Vocabulary Test - P.P.V.T.) and a non-verbal intelligence test (Queensland Test - Q.T.).

It was expected that the correlation coefficients obtained by the two samples for the P.P.V.T. and Q.T. would differ significantly as it was assumed that because of the differences in their ability to hear speech, the deaf and hard of hearing could be considered to be samples from different populations. It was also assumed that the hard of hearing sample who have acquired greater language facility will score significantly higher on a verbal intelligence test (P.P.V.T.) than will the deaf sample.

Since spatial motor tasks can, for the most part, develop independently of language it was predicted that the performance of the deaf and hard of hearing samples on a non-verbal intelligence test would not differ significantly.

In summary, the purpose of this study was to compare the verbal and non-verbal intelligence test scores obtained by a sample of deaf and hard of hearing children.

CHAPTER II

REVIEW OF LITERATURE

Vernon's Model

The hierarchical model proposed by Vernon (1961) of the factors which consistently emerge when the results of various ability tests are analyzed will be used (see Figure 1) as a basic model in this study. This model conceives of abilities as being organized in a hierarchy from relatively specific abilities, (e.g. reading, spelling, clerical, mathematical, scientific and technical abilities, etc.) at the lowest level to general cognitive abilities (g) at the highest and most general level.

Vernon concludes that "although small groups of factors can be isolated in many types of cognitive tests no intellectual faculties beyond (g) (general cognitive ability) and (v) (reading, spelling, linguistic and clerical abilities) are yet established as having educational or vocational importance" (1961, p. 49). According to Vernon's model the general cognitive ability (g) of the individual breaks down into intellectual faculties which he labels as v:ed, a type of verbal linguistic ability and k:m, a combination of mechanical, psychomotor, physical and spatial abilities.

It is with these two factors, v:ed (verbal linguistic ability) and k:m (spatial motor ability) that this study will be concerned. According to Vernon, if a child is "intelligent" he will have achieved certain general cognitive abilities (g). If, however he is unable to develop reading, spelling, linguistic and clerical abilities due to deafness he may not develop verbal linguistic abilities (v:ed) as would the normal child and consequently he would be expected to do poorly on any test

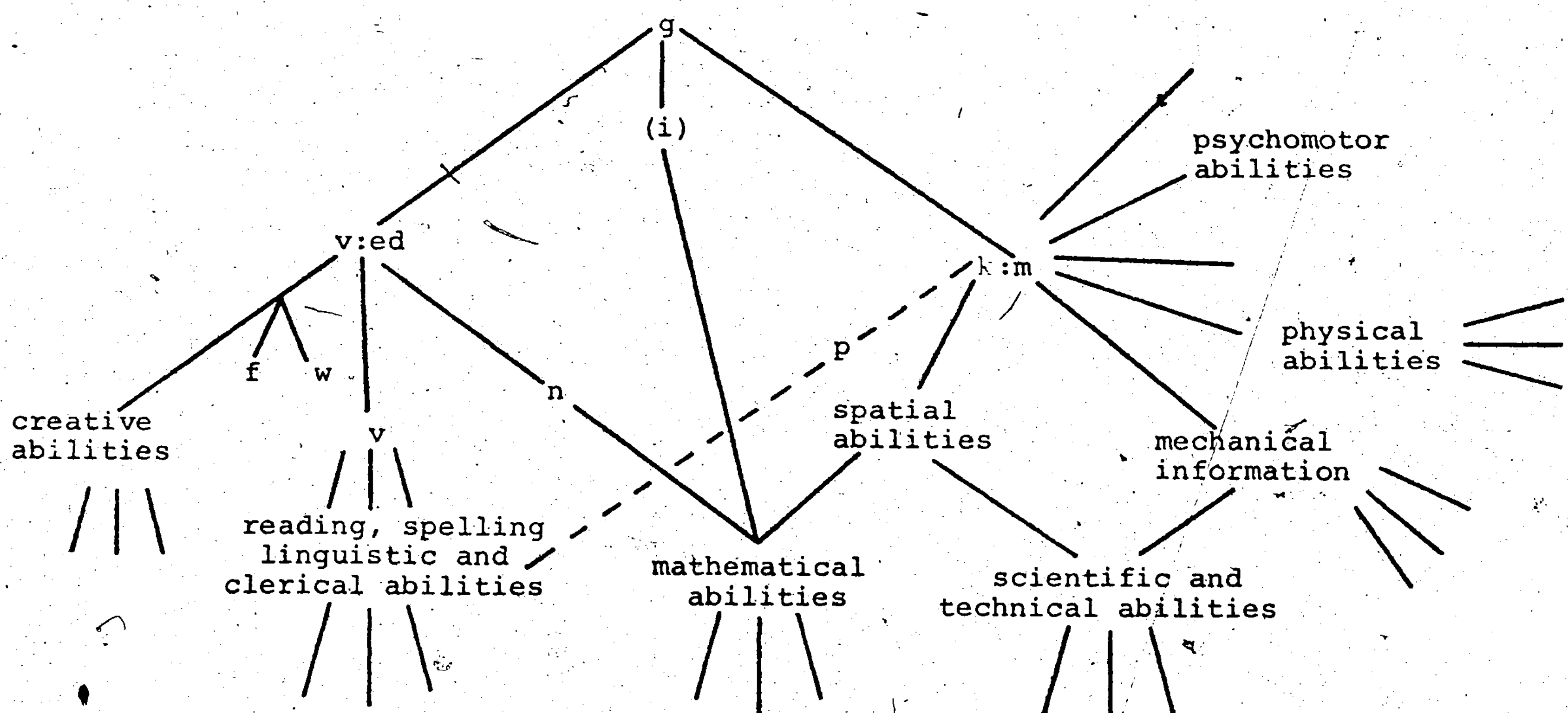

Figure 1. Hierarchical Model of the Factors that Emerge When a Variety of Ability Tests are Applied to European-American Cultures. (Vernon, 1965)

which purports to measure <u>v:ed</u> or some sub factor of this faculty. This fact would not mean, however, that a deaf child could not develop spatial motor abilities (k:m) which are in keeping with the normal child as the information required to gain this faculty can be and often is presented to the individual non-verbally. Consequently if a non-verbal test of conceptual abilities was presented to a deaf child it is presumed that this child's performance may be comparable to the hearing child's performance. It should follow that the "hard of hearing" child whose hearing handicap is much less severe than that of the "deaf" child should be able to develop reading, spelling, linguistic and clerical skills much more easily; consequently on measures of the child's v:ed (or verbal linguistic ability) the "hard of hearing" child should do significantly better than the deaf child. However since the k:m (or spatial motor ability) factors which Vernon has found to emerge are by definition only indirectly related to verbal ability, the performance of the "hard of hearing" child and the "deaf" child would not be expected to be significantly different on measures of these abilities.

<u>Intelligence Test Comparisons</u>

Researchers have been involved in comparing the test performances of the deaf child with that of the hearing child in various ability tests to determine what qualitative differences exist in the factors that emerge.

In 1920 Pintner and Reamer conducted a survey involving 2,172 hearing impaired children in 26 schools for the deaf in the United States to determine their mental and educational capacities. The conclusion reached by Pintner and Reamer was that on the average the deaf child is retarded two years mentally and five years educationally. This study raised the question as to the relationship between intelligence and deafness and the outcome has been debated ever since.

Sophistication of testing research as well as a better understanding of the deaf since the Second World War has allowed researchers to become cognizant of some of the factors which must be controlled when comparing a hearing sample with a deaf sample on the same intelligence test. Some have found, for example, that on certain non-verbal intelligence tests that if a standard method of administration is used with both groups the performance of a deaf sample is comparable to that of a hearing sample.

In 1953 Graham and Shapiro found that on the Performance Scale of the Wechsler Intelligence Scale for Children (W.I.S.C.) no significant differences were noted between the performance of a group of twenty deaf children and twenty hearing children when the test was administered to both groups of children via pantomime. They did find, however, that when the performance section was administered orally to a group of twenty hearing children and by pantomime to a group of twenty deaf children the hearing children performed significantly better on the total Performance Scale as well as three of its subtests: Picture Arrangement, Coding and Mazes. As the groups were equated in intelligence it would seem that the difference in performance was due to the method of administration.

Brown, Stern and Roher (1947) standardized the Chicago Non-Verbal Examination on hearing children using both verbal and pantomime directions because of the decrease in performance scores they noted when the test was administered via pantomime.

Often through necessity the hearing impaired child is compared with hearing children when the method of administering the tests differ.

This practice seems inappropriate when one considers that the method of administration can on given intelligence tests make a significant difference in the performance of the individual.

Another factor which, through research, has been shown to affect the test performance of the hearing handicapped is whether the intelligence test being given is a verbal or non-verbal intelligence test.

Because Goetzinger and Houchins (1969) felt there was a lack of research with young deaf children using non-verbal intelligence tests they used the 1947 Coloured Raven's Progressive Matrices to see if the performance of samples of deaf and hearing children differed.

Raven describes the Coloured Matrices as "a measure of observation and clear thinking" (1956, p. 20) which indicates whether a person can form comparisons and reason by analogy and to what extent he is capable of organizing spatial perceptions into systematic related wholes (Raven, 1956). Forty deaf and forty hearing children with approximately equal sex representation at two age levels (6 1/2 years and 8 1/2 years) were used by Goetzinger and Houchins. For the deaf subjects, congenital deafness or early severe deafness and intelligence within the normal limits as estimated by the children's teachers were prerequisites. The normal subjects were required to have normal hearing as determined by school testing and normal intelligence as estimated by their teachers. The deaf children were tested in pairs while the hearing subjects were tested in groups of four. Pantomime directions were used for all deaf subjects, however as Goetzinger and Houchins were aware that pantomime instructions can deleteriously affect performance on some non-verbal tests, half of the hearing group were given pantomime directions while the other half were given verbal directions.

Goetzinger and Houchins found that the deaf child's performance did not differ significantly from the hearing child's performance on the 1947 Coloured Progressive Matrices and that the use of verbal directions versus pantomime directions did not, on this intelligence test, significantly affect the performance of the individuals. These findings are especially significant considering that analytical studies (Olson and MacArthur, 1968; Vernon, 1965 a, 1965 b) offer evidence that the Raven Coloured Progressive Matrices is a good measure of general cognitive ability.

Willis, Wright and Wolf (1972) tested 40 hearing children and 40 deaf children between 6 years 1 month and 9 years 11 months of age and found that on the performance scale of the W.I.S.C. (Wechsler Intelligence Scale for Children) there was no significant I.Q. differences between deaf and hearing subjects.

Ferrant's interest in the deaf led to a study in which he compared the intellective abilities of deaf and hearing children by factor analysis (1964). He investigated typical differences of the deaf from the norms for hearing groups on specific types of subtests. A battery of intelligence and achievement tests and subtests consisted of the following items: (1) Goodenough's Draw-A-Man Test; (2) Gates' Primary Paragraph Reading Test, Form 3; (3) Gates' Advanced Primary Paragraph Reading Test; (4) The Chicago Non-Verbal Examination; (5) I.P.A.T. Culture Free (or Fair) Intelligence Test, Scale 2, Form A; (6) Coloured Progressive Matrices; (7) S.R.A. Primary Mental Abilities, Elementary Version for ages 7 - 11 years, Form AH. This battery was administered to a sample of one hundred and twenty hearing impaired children and one hundred and twenty hearing children. Ferrant found that the hearing impaired children were retarded when compared with the hearing children on tests involving verbal comprehension and abstract figural reasoning. It is interesting to note, however that on the Progressive Matrices the deaf were not found to be inferior on abstract figural reasoning. He found that the abilities of the hearing impaired were less integrated than were those of the normal hearing. Additionally, some of the tests yielded different factors for the two samples leading Ferrant to believe that "deafness hampers the integration of mental abilities and distorts some of them" (1964, p. 325).

Kearney also became concerned over the paucity of psychological and educational research with deaf subjects. She felt that one of the main reasons was the "lack of well researched instruments for the accurate and reliable assessment of the cognitive abilities of the deaf" (Kearney, 1969, p. 2). As discussed earlier, research has shown that on certain intelligence tests the performance of an individual can be affected by the type of administration instructions that are used, e.g., verbal versus pantomime instructions. Also a verbal intelligence test places the deaf individual at a disadvantage because he is hampered through his deafness in learning verbal skills. If comparisons of ability are to be made between the deaf population and some other population, e.g., hearing, hard of hearing, an instrument must be used which is non-verbal or which measures the spatial motor ability (k:m) of the individual and which does not require the use of any verbalizations from the test administrator or the subject. Ideally, the tasks should not be contaminated by verbal mediators. Such a test could be used with deaf persons without further adaptation and could be used to compare deaf subjects with hearing and hard of hearing subjects. Kearney (1969) states that "an intelligent deaf subject who is rated low on a verbal intelligence test is rated so because of his deafness "and" a wrong diagnosis of his intelligence has been made" (p. 3).

A study was undertaken by Kearney (1969) in order to investigate more fully the adequacy of the Queensland Test as a measure of the general cognitive ability (Vernon's k:m or spatial motor ability) of deaf subjects. It has already been shown that the test can be used with normal populations. The Queensland Test developed by Kearney and McElwain at the University of Queensland does not require the use of overt language. Instructions for the Queensland Test are not verbal and they are not required to communicate the problems. The responses of the subject are not oral or written, consequently test items on the Queensland are restricted to the performance type. During test construction, care was taken to exclude any tasks which require or are facilitated by internal language.

Kearney used 120 children from the School for the Deaf in Brisbane, Australia ranging in age from 7 years to 14 years. These children were matched with a similar number of hearing children of the same age and grade range from a typical state school. In 1965 the children were tested on the Queensland Test and one year later the eight year old population were retested using a wide battery of tests including the Queensland Test. Kearney found a significant correlation ($r = .69$, $p < .01$) for test scores on the Queensland compared with ability in the classroom situation. Also high positive correlations were found to exist between the Queensland and other test scores such as the Snijders-Oomen Non-Verbal Test of Deaf Intelligence. According to her results the deaf did score slightly behind the normal sample on the Queensland Test leading

Kearney to conclude that this "happens even though the test is adequately measuring the cognitive ability of the deaf" (p. 11). Kearney speculates "that it may not be possible to remove all verbal components of a test and at the same time retain validity for both deaf and normal subjects. The verbal ability that is needed may be inherently present in the normal subject but may have to be actively brought into use by the deaf," (p. 11) and concludes that "the development of a test ought to aim, not at eliminating verbal components completely, as this may be impossible, but at controlling them to a point where the test is within the capacity of deaf subjects" (p. 11).

Ability Patterns and Related Research

Unfortunately a good deal of research time and effort has been spent attempting to determine whether or not the deaf are quantitatively as "intelligent" as the hearing. It now appears that the significant question concerns the qualitative differences in intelligence between deaf and hearing individuals. It is becoming increasingly evident that the deaf subject cannot compete with the hearing subject on an intelligence test which measures verbal linguistic ability (v:ed) or some facet of it but that they can compete on tasks measuring spatial motor ability (k:m). Kearney (1969) has shown, however that it is difficult if not impossible to create a test which is free of all verbal mediation. In Vernon's model (Figure 1) v:ed subdivides into V (the ability to understand verbal material) and N (Number Ability). The ability to understand verbal material or V branches into reading, spelling, linguistic and clerical abilities and subsequently influences the spatial motor functioning of the individual. N or number ability directly influences mathematical ability. Vernon also includes a P factor, a factor of Perceptual

Speed first introduced by Thurston. It involves rapid visual inspection and identification of letters, numbers, words, shapes, and affects spatial motor ability (k:m) directly. It becomes increasingly complicated to devise a test which could be said to test only abilities of a non-verbal nature because the spatial motor ability of the (k:m) of an individual is influenced directly and indirectly by verbal linguistic ability (v:ed) (Vernon, 1965).

Along another line of study evidence supports the existence of different ability patterns for various cultural groups.

Much of MacArthur's research (1968, 1969) deals with the ability patterns that he has found emerge when ability tests are applied to individuals within different cultural groups. Through factor analysis MacArthur (1973) has shown that different patterns of cognitive abilities emerge for different groups and he concludes that careful attention be given to the construct validity of psychological tests used in different cultural contexts.

Although MacArthur's research has not included the deaf it is consistent with his findings that the deaf can be considered a special group which may present different ability patterns as they have had to develop their general intellectual ability through spatial motor or k:m abilities rather than through verbal linguistic or v:ed abilities.

In 1953 Glowatsky investigated the possibility that the congentially deaf and hard of hearing may present different ability patterns. It was the purpose of his study to compare the intelligence scores obtained on the Verbal Scale of the Wechsler Intelligence Scale for Children (W.I.S.C.) with the intelligence scores obtained on the Performance Scale of the W.I.S.C., on the Grace Arthur Scale and on the Goodenough test. The study was conducted at the New Mexico School for the Deaf in Santa Fe and involved testing a total of twenty-four deaf and twenty-four hard of hearing children. The children ranged in age from 7 years 5 months to 15 years 7 months inclusive. Twelve boys and twelve girls were included in the sample and ten children were classified as deaf while the remaining were classified as hard of hearing. Glowatsky found that the deaf and hard of hearing obtained means on the Full Scale W.I.S.C., Goodenough, Arthur, and Performance Scale of the W.I.S.C. that were significantly higher than the mean on the Verbal Scale of the W.I.S.C. He noted no differences between the deaf and hard of hearing on any of the scales.

<u>Summary</u>

More research is needed in the area of testing of the deaf and hard of hearing child to find out as much as possible about the intelligence, abilities and disabilities of these children in order that better education techniques be devised. Only then can educators of the hearing impaired child become more effective.

The research cited indicates that if comparisons are to be made between hearing and hearing impaired children the method of test administration becomes important. The use of pantomime versus verbal instructions, for example, can make a significant difference in test performance. Also the verbal test has not given a true picture of the hearing impaired child's intellectual ability. The most recent research done deals (through factor analysis, comparison of verbal and non-verbal tests, etc.) with the ability patterns of the hearing impaired child and it parallels some of the cross-cultural research that has and is being done.

CHAPTER III

DEFINITIONS, RATIONALE AND HYPOTHESES

DEFINITIONS

Testing Instruments Used

For this study two types of testing instruments were required; one which would test some facet of the individual's verbal ability or v:ed and one which would test the cognitive, spatial motor ability (k:m) of the individual. In order to be suitable for both hard of hearing and deaf samples the tests used would have to incorporate the following features:

It must be possible to give, without ambiquity, the needed instructions by pantomime or gesture.

The test should not include speed tests as it is difficult to make the deaf child realize that he should work as quickly as possible yet carefully and accurately; that he should start at a given time and stop at another; etc.

Practice material should be included in the test to give the subject a chance to become acquainted with the type of responses that are required of him.

The test materials should be of such a nature and arranged in such a manner as to capture and retain the interest of the child.

It should be possible to administer the test quickly. (As two tests were being administered to the same child in the same day the tasks could become tedious to the child if the tests were unduly long).

Peabody Picture Vocabulary Test (P.P.V.T.)

This instrument was chosen as a test of one facet of verbal linguistic ability (v:ed). Dunn (1959, p. 25) states that "the P.P.V.T. is designed to provide a well-standardized estimate of a subject's verbal intelligence through measuring his hearing vocabulary" and it "measures verbal rather than quantitative, social, practical, or mechanical intelligence." Terman and Merrill (1937) indicate that they found the vocabulary test to be the most valuable single test in the revised Stanford-Binet Tests of Intelligence. On the Wechsler Intelligence Scale for Children, Wechsler (1949) found the vocabulary subtest scores to correlate more highly with Full Scale I.Q. scores than any other subtest. Dale and Reichert (1957) have found the vocabulary test to be the best single factor for predicting school success. Considering these findings, the P.P.V.T. would appear to be a valid measure of the verbal linguistic ability (v:ed) of an individual.

The P.P.V.T. is a power test rather than a speed test. It is possible to give directions through pantomime and no oral response is required of the subject (Dunn (1959) endorses the use of the P.P.V.T. with special groups). Also, practice items are included in the P.P.V.T. The test has high interest value and is quickly administered (only 10 to 15 minutes are usually required to give this test).

The Queensland Test (Q.T.)

This instrument was selected to measure the cognitive, spatial motor ability (k:m) of the hard of hearing and deaf samples in this study. "The test and its predecessor, the P.I.R. Test, were developed over a period of about ten years in the Department of Psychology at the

University of Queensland" (McElwain and Kearney, 1970, p. 1). The test was developed for the selection of persons for training on complex European skills/from groups where, because of communications barriers, the psychological tests usually used in European groups were inapplicable (McElwain and Kearney, 1970). The Q.T. is a non-verbal, non-language performance test which measures spatial motor abilities. "It is markedly 'culture reduced' when compared with most tests in general use" (McElwain and Kearney, 1970, p. 4).

The Q.T. was especially valuable for this study in that the communication between the tester and the subject is through physical movements. Thus it is not hindered by language or verbal barriers. The Q.T. subtests are in essence untimed and it is, in effect, a power test that gives little weight to the speed of performance of the individual. In each subtest on the Q.T. the examiner does something with a set of materials and invites the subject to imitate him on an identical set of materials. In each subtest the subject is allowed to practice enabling him to become acquainted with the responses required. The materials are stimulating and each subtest resembles a game or puzzle. The test is quickly administered (30 to 45 minutes) and moves rapidly from subtest to subtest. The five subtests making up the Q.T. are: (1) Knox Cube Test (Knox, 1914); (2) Beads Test (an adaptation of the Binet Beads Test); (3) Passalong Test (Alexander, 1932); (4) Form Assembly (a form-board test); (5) Block Design (a mosaic test). Kearney (1969, p. 11) has stated that "it would seem that the five subtests of the Q.T. involve the measurement of memory (retention), motor skills (reproduction), cognition, observation (visualization), reasoning, abstraction, spatial and number skills." According to Kearney the Q.T. does not measure verbal intelligence or Vernon's v:ed and she concludes that the issue still remains as to "whether intelligence can be measured without taking a verbal factor into account."

Kearney has shown that the Q.T. is a valid and reliable measure of cognitive ability for both deaf and hearing populations but cautions against deriving inferences from individual subtest scores or from subtest score differences.

Classifications Used (Deaf versus Hard of Hearing)

Myklebust (1964) defines the congenitally "deaf" as those individuals who are deaf at birth and who experience an eighty-five to one hundred decibel hearing loss. For this type of individual, amplification is used to maintain intelligible speech and to focus on loud environmental sounds. He advocates that these individuals must use vision and tactile cues to maintain homeostatic equilibrium. They find it difficult to interact with hearing children and adults, and special educational techniques are necessary to enable them to learn.

According to Mykelbust (1966) the congenitally hard of hearing are the individuals who have a thirty to forty-five decibel hearing loss at birth. This hearing loss is often referred to as moderate and it tends to affect the scanning and background functions of the deaf. This individual finds conversation difficult without amplification and he experiences impaired awareness as well as detachment from the environment. At this level, restrictions imposed on communication can be alleviated by amplification and proximity to the speaker. Although these children also require special remediation techniques, they are frequently retained in special classrooms within the public school system.

It is becoming increasingly evident to those working with hearing impaired children that although a child may experience a given hearing loss (an average in decibels of the measured levels, at the speech frequencies - 500, 1,000, 2,000 cycles per second, at which the child is able to hear pure tones presented through phones or to a sound field) he may not function as expected. Consequently a definition such as Myklebust's which uses a decibel range to group individuals as deaf or hard of hearing is of little value in that no comment is made on the hearing impaired child's ability to hear speech.

Factors such as the intelligence and personality of the child, the socio-economic status and attitude of the parents, the age of onset (whether the child has lost his hearing before or after language acquisition), etiology, type of loss (high frequency, etc.), type and amount of therapy and special remediation received, the presence of other handicaps, etc. all influence the development and consequently the way in which the hearing impaired child is able to perceive.

Oyer (1966) describes the following measures which have been derived as ways of describing the perception of hearing impaired individuals:

Speech Awareness Threshold (S.A.T.): This is a measure of the child's ability to determine the presence of speech. It is not necessary that the child understand the words being said, but merely that he be able to indicate that speech is being delivered through a sound field or phones.

Speech Reception Threshold in Quiet (S.R.T.): This threshold is a measure of the child's ability to correctly repeat fifty percent of the spondaic two syllable words that have been presented either through phones or to a sound field. This threshold compares favorably with the average of the threshold for detection of pure tones 500 cps, 1000 cps and 2000 cps. The S.A.T. and S.R.T. may be influenced by, but are not dependent on, the decibel loss experienced by the hearing impaired child.

Because this study is concerned with the amount of speech the hearing impaired child receives (as this determines the amount of language vocabulary, etc. the child is able to hear) the S.R.T. obtained by the child rather than his decibel hearing loss was used as a basis of classification.

The deaf in this study were those children for whom no S.R.T.'s could be obtained. The children in this sample were aware of speech and S.A.T.'s were obtained for them, however they were unable, even with maximum amplification, to hear speech well enough to repeat spondaic two syllable words (presented through phones) with fifty percent accuracy. The words were presented through phones and in each case the child's S.R.T. was recorded. Both samples were tested by audiologists from the Department of Speech Pathology and Audiology, Glenrose Hospital, Edmonton, Alberta.

The age of onset of deafness can significantly affect the language development of the hearing impaired child. For example the child who becomes hearing impaired after he has acquired some language (e.g., approximately after the age of three years) would be expected to incorporate language skills with greater ease than would the child who is hearing impaired at birth. All of the children used in the deaf and hard of hearing samples, for whom the age of onset of deafness could be determined, became hearing impaired before the age of twenty-six months (see Table I).

TABLE I

AGE OF ONSET OF DEAFNESS FOR BOTH SAMPLES

AGE OF ONSET	DEAF SAMPLE		HARD OF HEARING SAMPLE	
	Number	Percent	Number	Percent
Birth	16	64	18	72
Before Twenty-Six Months	7	28	6	24
Undetermined	2	8	1	4
TOTAL	25	100	25	100

Consequently, for both samples, when the age of onset of hearing impairment could be determined, the children became hearing impaired before they were able to acquire language.

The Etiology of Deafness refers to the scientific study of causation of deafness.

The etiologies of the deafness varied for the deaf and hard of hearing samples and the etiological classifications employed were endogenous (inherited deafness), exogenous (deafness resulting from external causes, e.g., birth trauma, diseases, etc.), meningitis, Rubella Syndrome and undetermined (see Table II). Meningitis and Rubella Syndrome were classified separately because of the importance of these diseases in the etiology of deafness.

RATIONALE AND HYPOTHESES

A verbal intelligence test composed of items involving verbal concepts which depend on language will place the hearing handicapped child at a disadvantage. This conclusion was reached by Myklebust in 1966 and led him to hypothesize that the hearing impaired have difficulty forming and using verbal abstractions but they do as well as, or better than the hearing on spatial motor tasks. Also, the hard of hearing child whose language development would be expected to be closer to that of the normal child should be expected to perform better than the deaf child on a test composed of verbal linguistic tasks (v:ed). Since it is proposed that deafness does not affect the ability to conceptualize on a non-verbal level the deaf and hard of hearing samples are expected to obtain similar scores on a test measuring spatial motor ability or k:m.

TABLE II

INCIDENCE OF DEAFNESS BY ETIOLOGY FOR BOTH SAMPLES

ETIOLOGY	DEAF SAMPLE		HARD OF HEARING SAMPLE	
	Number	Percent	Number	Percent
Endogenous	1	4	0	0
Exogenous	6	24	10	40
Meningitis	2	8	3	12
Rubella Syndrome	3	12	6	24
Undetermined	13	52	6	24
TOTAL	25	100	25	100

The hypotheses of this study are:

Hypothesis I: There will be a significant difference at the .05 level between the correlation coefficients obtained by the deaf and hard of hearing for the P.P.V.T. and Q.T.

Hypothesis II: There will be a significant difference at the .05 level between the raw score obtained by the deaf and hard of hearing on the P.P.V.T.

Hypothesis III: There will be no significant difference at the .05 level between the raw score obtained by the deaf and hard of hearing on the Q.T.

CHAPTER IV

METHOD

Procedure

This study was conducted in the City of Edmonton, Alberta, an urban center of approximately 442,365 people (October, 1973 Census). The data was collected during the months of May and June of 1973. Forty-one children were tested at the Alberta School for the Deaf which is a residential school under the jurisdiction of the Alberta Government. The school was built in 1955 as a facility for deaf children throughout the province of Alberta, however, a few children from outside the province of Alberta do attend the Alberta School for the Deaf. Three children from the Northwest Territories have been included in the sample of deaf youngsters. Thirty-nine children were tested at Windsor Park Elementary School where the Edmonton Public School System has set up five special classes for the hard of hearing within the City of Edmonton. As most school districts do not have facilities for the hard of hearing a few children from outside of Edmonton stay in foster homes to enable them to attend the Hearing Conservation classes at Windsor Park. Two hard of hearing children from outside of Edmonton were used in this study and helped make up the hard of hearing sample. Twenty-five hard of hearing children from five classes were chosen from the Hearing Conservation classes at Windsor Park Elementary School. These children were matched for sex and age within six months with twenty-five deaf children from the Alberta School for the Deaf. Children suspected of being mentally defective, emotionally disturbed or severely cerebral palsied were omitted. One hard of hearing child diagnosed as having cerebral palsey was used. This boy's palsey was very slight and his teacher reported that it did not appear to affect this boy's mental or physical functioning. Test data substantiated the teacher's observations.

It is interesting to note that the medium of instruction differs in that on Oral approach is used as a medium of instruction in the Hearing Conservation classes while a Total Communication approach is used at the Alberta School for the Deaf. By definition Total Communication refers to the use of finger-spelling, signing, speech and speech reading as a method of instructing the deaf child.

As neither the deaf nor the hard of hearing children are graded and various reading levels often exist in the same classroom no reference will be made to the child's grade or classroom level. It was felt that for purposes of this study grouping according to age would prove more meaningful. The etiologies of the hearing losses varied and where it could be determined all of the children obtained their hearing losses before the age of twenty-six months. Table III gives clinical data regarding the subjec

TEST ADMINISTRATION

The Peabody Picture Vocabulary Test (P.P.V.T.) (Form A) and Queensland Test (Q.T.) (five subtests) were administered to both the hard of hearing and deaf samples. Both tests were administered during the same testing session and the P.P.V.T. always preceeded the Q.T.

Peabody Picture Vocabulary Test (P.P.V.T.)

The standard method of administration was used for the hard of hearing sample. The examiner faced the subject, spoke in a clear voice and repeated words when the child asked the examiner to do so, looked puzzled, or hesitated. With the deaf child, pantomime instructions were given while

CLINICAL DATA DESCRIBING THE SUBJECTS

SUBJECT NUMBER	SCHOOL	SPEECH RECEPTION THRESHOLD RIGHT EAR	SPEECH RECEPTION THRESHOLD LEFT EAR	SPEECH AWARENESS THRESHOLD RIGHT EAR	SPEECH AWARENESS THRESHOLD LEFT EAR	DESCRIPTION OF DIAGNOSED HEARING LOSS	AGE OF ONSET	ETIOLOGY (CAUSE OF DEAFNESS)
1	A.S.D.			55dB	55dB	Severe Belateral	Undetermined	Undetermined
2	H.C.	75dB	75dB			Severe Bilateral	Twenty-Four Months	Exogenous
3	A.S.D.			CNT	CNT	Profound Bilateral	Undetermined	Undetermined
4	H.C.	50dB	45dB			Moderate Bilateral Sloping From Mild in Low Frequencies to Severe in High Frequency	Birth	Undetermined
5	A.S.D.			80dB	85dB	Severe to Profound Bilateral	Birth	Rubella Syndrome
6	H.C.	70dB	65dB			Severe Bilateral	Birth	Rubella Syndrome
7	A.S.D.			50dB	CNT	Profound Bilateral	Birth	Endogenous
8	H.C.	CNT	80dB			Profound - Right Ear Severe - Left Ear	Birth	Undetermined
9	A.S.D.			55dB	85dB	Severe to Profound Bilateral	Twelve Months	Meningitis
10	H.C.	90dB	85dB			Severe Bilateral	Birth	Rubella Syndrome
11	A.S.D.			CNT	CNT	Profound Bilateral	Eighteen Months	Undetermined
12	H.C.	80dB	80dB			Severe Bilateral	Birth	Exogenous
13	A.S.D.			55dB	70dB	Severe Bilateral	Six Months	Exogenous
14	H.C.	75dB	CNT			Severe Bilateral	Birth	Rubella Syndrome

A.S.D. - Alberta School for the Deaf

H.C. - Hearing Conservation Classes (Edmonton Public School)

CNT - Can Not Test

dB - Decibels

Endogenous - Inherited deafness

Exogenous - Deafness resulting from external causes, e.g. diseases

SUBJECT NUMBER	SCHOOL	SPEECH RECEPTION THRESHOLD RIGHT EAR	SPEECH RECEPTION THRESHOLD LEFT EAR	SPEECH AWARENESS THRESHOLD RIGHT EAR	SPEECH AWARENESS THRESHOLD LEFT EAR	DESCRIPTION OF DIAGNOSED HEARING LOSS	AGE OF ONSET	ETIOLOGY (CAUSE OF DEAFNESS
15	A.S.D.			75dB	80dB	Severe to Profound Bilateral	Birth	Rubella Syndrome
16	H.C.	55dB	65dB			Moderate - Right Ear Severe - Left Ear	Birth	Rubella Syndrome
17	A.S.D.			75dB	70dB	Profound Bilateral	Eighteen Months	Exogenous
18	H.C.	60dB	60dB			Moderate Bilateral	Birth	Rubella Syndrome
19	A.S.D.			CNT	85dB	Profound Bilateral	Birth	Rubella Syndrome
20	H.C.		80dB	90dB		Profound Bilateral	Twelve Months	Exogenous
21	A.S.D.			30dB	60dB	Profound Bilateral	Birth	Undetermined
22	H.C.			90dB	90dB	Profound Bilateral	Fourteen Months	Meningitis
23	A.S.D.			105+dB	85dB	Profound Bilateral	Birth	Exogenous
24	H.C.	25dB	55dB			Moderate High Frequency - Right Ear Moderate - Left Ear	Birth	Rubella Syndrome
25	A.S.D.			95dB	90dB	Profound Bilateral	Birth	Undetermined
26	H.C.	80dB	80dB			Severe Bilateral	Birth	Exogenous
27	A.S.D.			80dB	80dB	Severe Bilateral	Birth	Undetermined
28	H.C.	80dB	CNT			Severe - Right Ear No Measureable Hearing - Left Ear	Twelve Months	Meningitis
29	A.S.D.			60dB	CNT	Profound Bilateral	Birth	Undetermined
30	H.C.	85dB	CNT			Severe - Right Ear Profound - Left Ear	Birth	Undetermined
31	A.S.D.			70dB	75dB	Severe to Profound Bilateral	Birth	Undetermined
32	H.C.			75dB	70dB	Severe to Profound Bilateral	Birth	Undetermined
33	A.S.D.			90dB	85dB	Profound Bilateral	Twenty-Two Months	Meningitis
34	H.C.	40dB	30dB			Moderate - Right Ear Mild - Left Ear	Undetermined	Undetermined

SUBJECT NUMBER	SCHOOL	SPEECH RECEPTION THRESHOLD RIGHT EAR	SPEECH RECEPTION THRESHOLD LEFT EAR	SPEECH AWARENESS THRESHOLD RIGHT EAR	SPEECH AWARENESS THRESHOLD LEFT EAR	DESCRIPTION OF DIAGNOSED HEARING LOSS	AGE OF ONSET	ETIOLOGY (CAUSE OF DEAFNESS)
35	A.S.D.			65dB	65dB	Severe to Profound Bilateral	Birth	Undetermined
36	H.C.	60dB	75dB			Severe - Right Ear Profound - Left Ear	Birth	Exogenous
37	A.S.D.			75dB	CNT	Profound Bilateral	Sixteen Months	Exogenous
38	H.C.	60dB	65dB			Severe Bilateral	Birth	Exogenous
39	A.S.D.			80dB	75dB	Profound Bilateral	Birth	Undetermined
40	H.C.	50dB	60dB			Severe Bilateral	Birth	Exogenous
41	A.S.D.			65dB	65dB	Profound Bilateral	Birth	Undetermined
42	H.C.	40dB	45dB			Mild to Moderate Mixed Type Bilateral Hearing Loss (Loss is Severe to Profound in the High Frequency in Both Ears).	Birth	Exogenous
43	A.S.D.			65dB	65dB	Severe to Profound Bilateral	Birth	Undetermined
44	H.C.	45dB	45dB			Moderate Bilateral	Birth	Undetermined
45	A.S.D.			CNT	CNT	Profound Bilateral	Birth	Undetermined
46	H.C.	CNT	45dB			No Measureable Hearing - Right Ear Moderate - Left Ear	Six Months	Meningitis
47	A.S.D.			60dB	65dB	Severe to Profound Bilateral	Birth	Exogenous
48	H.C.	60dB	30dB			Severe - Right Ear Mild - Left Ear	Twelve Months	Exogenous
49	A.S.D.			90dB	90dB	Profound Bilateral	Twenty-Six Months	Exogenous
50	H.C.	70dB			80dB	Severe - Right Ear Profound - Left Ear	Birth	Exogenous

the examiner presented example A, B, and C; e.g. the examiner finger-spelled and verbalized the word, spoon, then indicated through pantomime that the child should point to the word. When the subject pointed to the correct word the examiner smiled, said yes, and shook her head up and down. Trials B and C were administered in the same manner. Instead of only verbalizing the stimulus word as was done with the hard of hearing sample, the stimulus word was finger-spelled and verbalized for each test item.

Praise and encouragement were given to both groups by nodding approval, smiling and verbalizations; e.g. "Good", "That was a good answer". As deaf and hard of hearing children are especially good at watching for facial cues the examiner was careful to give no indication as to whether the child's response was correct or incorrect. It is interesting to note that none of the children tested appeared to have any difficulty understanding the instructions given.

It was felt that since the hard of hearing sample are instructed orally and the deaf through the use of finger-spelling and signs in conjunction with verbalizations that neither group was being placed at a disadvantage. Finger-spelling rather than signs were used with the deaf subjects as signs often depict through pantomime the objects they represent. For this reason it was felt that by using signs the deaf child would be placed at a distinct advantage. Also when the data was collected (May and June, 1973) the signs used at the Alberta School for the Deaf were not standardized and it was felt that this would favor the child who was more familiar with the signs used by the examiner. The examiner felt the method of administration was justified as the Peabody was to be used to compare the verbal intelligence of the hard of hearing sample with the deaf sample and this would not entail use of the P.P.V.T. norms. Also, the adaptations made in test administration were the only way in which the deaf sample could be compared with a hard of hearing sample.

Testing was discontinued when the subject failed 6 out of 8 items. The total raw score for each individual was the number of correct items answered and was calculated by subtracting the number of errors from the ceiling score. Thus standard scoring procedures were used for both the deaf and hard of hearing samples.

Queensland Test (Q.T.)

As the Q.T. is a non-verbal intelligence test no adaption in administration was necessary for either the deaf or hard of hearing samples. Consequently all administration as well as all scoring procedures outlined in the Q.T. manual were followed for both samples.

CHAPTER V

PRESENTATION OF DATA AND RESULTS

Correlation coefficients for the Peabody Picture Vocabulary Test (P.P.V.T.) and Queensland Test (Q.T.) were calculated for both samples, then compared using Fisher's formula for the normal deviate or z-score to determine whether the correlations of the P.P.V.T. and Q.T. differed significantly for the deaf and hard of hearing samples (Hypothesis I).

The T-test was used to test whether a significant difference existed between the deaf and hard of hearing samples on the P.P.V.T. and Q.T. (Hypotheses II and III). The level of significance adopted to test the three hypotheses was $p > .05$.

Hypothesis I

Table IV displays the correlation coefficients for the P.P.V.T. and the Q.T. for the deaf and hard of hearing samples. The P.P.V.T. and Q.T. scores obtained by the hard of hearing correlated more highly than did the scores of the deaf sample. However, low positive correlations on the P.P.V.T. and Q.T. were obtained for both hard of hearing and deaf samples.

The correlation coefficient of the P.P.V.T. and Q.T. for the deaf sample was .276 compared to .386 for the hard of hearing sample. In order to test Hypothesis I (there will be a significant difference between the correlation coefficients of the Q.T. and P.P.V.T. for the hard of hearing and deaf samples) Fisher's Zr transformation was used. The correlation coefficients (.276 and .386) were converted to Zr values (.283 and .407). Using Fisher's formula the normal deviate or z-score

TABLE IV

CORRELATIONS FOR P.P.V.T. AND
Q.T. FOR BOTH SAMPLES

	CORRELATION	FISHER'S Zr
DEAF	.276	.283
HARD OF HEARING	.386	.407

was computed and found to be .411. Since the z-score needed for the two-tailed test at the .05 level is 1.96 and the z-score obtained was .411, the correlation coefficients were not significantly different at the .05 level. Hypothesis I was therefore rejected. It appears that the correlations of the P.P.V.T. and Q.T. do not differ significantly for the deaf and hard of hearing samples. The t-test was used to determine if these correlation coefficients were significantly greater than zero.

Since the t-score required for the two-tailed test at the .05 level is 2.069 and the t-score obtained between the correlation and zero for the deaf on the P.P.V.T. and Q.T. was 1.377 and for the hard of hearing was 2.006, neither correlation was significantly different from zero at the .05 level. Therefore in this study a significant relationship between the P.P.V.T. and Q.T. was not found for either the deaf or hard of hearing sample.

Hypotheses II and III

Table VI includes the means and standard deviations of the total P.P.V.T. raw score, the raw subtest scores of the Q.T. and the total Q.T. raw score.

The means of the deaf sample were 34.60 (P.P.V.T.) and 37.80 (Q.T. total score) compared to the means of the hard of hearing which were 47.84 and 33.88 for the P.P.V.T. and Q.T. total score respectively. As only two groups were being compared, the t-test rather than analysis of variance was used to test Hypotheses II and III.

This statistic yielded a t-score of 4.2024 ($p < .05$, $df = 48$). This value indicates that the P.P.V.T. raw score means were significantly different at the .05 level and supports Hypothesis II. It was concluded

TABLE V

MEANS AND STANDARD DEVIATIONS OF THE P.P.V.T. AND Q.T. FOR BOTH SAMPLES

	DEAF SAMPLE		HARD OF HEARING SAMPLE	
	Mean	Standard Deviation	Mean	Standard Deviation
P.P.V.T. - Total	34.60	10.92	47.84	12.31
Q.T. - Knox Cubes	8.48	2.31	8.32	2.56
Q.T. - Beads	4.60	2.25	3.72	2.53
Q.T. - Passalong	4.00	1.35	3.80	1.61
Q.T. - Form Assembly	10.20	1.91	8.84	2.01
Q.T. - Pattern Arrangement	10.52	3.32	9.16	4.16
Q.T. - Total	37.80	7.95	33.88	9.97

that there is a significant difference between the means of the raw scores obtained by the deaf and hard of hearing samples on the P.P.V.T. (the hard of hearing sample performed significantly better on the P.P.V.T.).

The difference between the deaf and hard of hearing group on the Q.T. (total) means was assessed with the t-test. This test yielded a t-score of 1.553 ($p > .05$, df = 48).

The Q.T. means are not significantly different at the .05 level for the two samples. Consequently Hypothesis III was accepted and it was concluded that no significant difference exists between the deaf and hard of hearing samples on the Q.T.

<u>Ancillary Findings</u>

Although McElwain and Kearney have emphasized that the Q.T. is a test, not a battery of tests and cautioned that though norms for the subtests could be established these "would be of less certain reliability" (1970, p. 12) it was felt that some interesting insights may be revealed by comparing the performance of the hard of hearing and deaf samples on the five subtests of the Q.T. (the results obtained are seen in Table VI). Only the Form Assembly subtest means were significantly different for the hard of hearing and deaf samples with the deaf group performing better than the hard of hearing group.

Summarizing these results, it is noted that the difference between the P.P.V.T. and Q.T. correlations was not found to be significant. However, the hard of hearing sample did significantly better than the deaf sample on the P.P.V.T. at the .05 level. The hard of hearing and deaf samples did not perform significantly differently on the Q.T. total score; However, on one Q.T. subtest, Form Assembly, the deaf sample performed significantly better than the hard of hearing sample.

TABLE VI

T-TEST SCORES - DIFFERENCES BETWEEN MEANS FOR THE FIVE SUBTESTS OF THE Q.T. FOR DEAF AND HARD OF HEARING GROUPS

SUBTESTS	T-SCORE	DF
1. Knox Cube Imitation	.232	48
2. Beads	1.300	48
3. Passalong	.476	48
4. Form Assembly	2.447*	48
5. Pattern Matching	1.278	48

* $p < .05$

CHAPTER VI

DISCUSSION

Many scores obtained by the deaf and hard of hearing subjects on the Peabody Picture Vocabulary Test (P.P.V.T.) were so low that no norms existed. Although the I.Q.'s of these subjects could have been calculated by using I.Q. = M.A./C.A. (Intelligence Quotient = Mental Age/Chronological Age) they could be "considered as estimates only" (Dunn, 1959). Also, no norms for performance of Canadian hearing impaired children existed for the P.P.V.T. or Queensland Test (Q.T.). For these reasons, all comparisons were made on the raw scores obtained by the deaf and hard of hearing samples.

Hypothesis I was rejected because the correlation coefficients of the two tests (P.P.V.T. and Q.T.) for each sample were not significantly different at the .05 level. In other words, the way in which the P.P.V.T. correlates with the Q.T. appears similar for both samples. Upon further analysis it became apparent that the correlation coefficients obtained for the deaf and hard of hearing sample do not differ significantly at the .05 level from a correlation of zero. Thus, for both samples the P.P.V.T. and Q.T. do not correlate. If a deaf or hard of hearing child is tested on the P.P.V.T. little prediction can be made as to the way in which he will perform on the Q.T. and vice versa.

A significant difference at the .05 level was found between the means obtained by the deaf and hard of hearing on the P.P.V.T. consequently; Hypothesis II was accepted. However, no significant difference at the .05 level was obtained for the Q.T. means, which lead to the acceptance of Hypothesis III. The P.P.V.T. measures one facet of verbal linguistic ability (v:ed) and tends to correlate highly with other verbal linguistic abilities (Terman and Merill, 1937). The hard of hearing in this sample scored significantly higher on the P.P.V.T. than did the deaf. As no difference was obtained between the two groups on a test measuring spatial motor (k:m) tasks or between the correlation coefficients of the two tests - the only difference between the deaf and hard of hearing sample was their performance on the P.P.V.T. The reason for this difference between the deaf and hard of hearing sample may be attributed to the different language levels of these two groups. It would seem that the Q.T. is a more appropriate measure of the intellectual ability of the hearing impaired child. It is interesting to note that although none of the deaf or hard of hearing children included in this study were retarded most of the children scored below their mental ages on the P.P.V.T.

Myklebust (1964) advocates that the children who have even small amounts of hearing are at a greater advantage as far as language acquisition is concerned than those who suffer a greater hearing loss. This phenomenom, he feels, is partly due to the increased communication received through lip reading (it has been shown by Myklebust (1964) that the more hearing a child has the more likely he is to use lip-reading). Therefore the deaf child suffers from a significantly greater handicap than does the hard of hearing child. The deaf child is also at a disadvantage in that he is unable to use expressive language (the deaf child may be thinking at a level comparable with the hard of hearing or hearing child) and he may be merely unable to express these thoughts. It would be erroneous therefore to assume that because the deaf child does not have the language to convey his thoughts that he does not think on the same level as does a hearing child of the same age. The handicap of the deaf may be that he has never acquired a language which satisfactorily conveys his thoughts and feelings. It is Furth's hypothesis that the sign language may be the language of the deaf (Furth, 1960) and that the syntax of the sign language may be very different from the syntax as known to the hearing. Furth would advocate that testing the deaf child requires the same type of procedures used for testing a child from another culture (MacArthur, 1969).

This study illustrates that the deaf and the hard of hearing to a lesser extent are not learning the language of the hearing adequately as assessed by the P.P.V.T. It has been found by Myklebust (1964) that if the deaf continue taking courses in English language (English literature as well as language courses) this will lessen the gap between the deaf and their hearing peers. Unfortunately educators of the hearing impaired have found it difficult to close this learning gap. Furth (1966) speculates that one of the reasons this gap between verbal and non-verbal conceptualization occurs is that the deaf child often does not receive any verbal stimulation until he begins to attend kindergarten or school. This is also true but less so for the hard of hearing. Furth suggests that a substitute, sign language, may be the way to make use of the preschool years of the deaf child. It becomes clear that language concepts must be taught to very young deaf and hard of hearing children to enable them to realize their full intellectual potential.

It is interesting to note that on one subtest (Form Assembly) of the Q.T. the deaf group performed significantly better than did the hard of hearing group. This finding could be unique to the samples used or it could be an example of the different ability patterns of the deaf and hard of hearing child. MacArthur (1972) has found that Central Eskimos and Nsenga Africans exhibit differing ability patterns and it does not seem inappropriate that deaf and hard of hearing samples show significant differences on specific cognitive tasks. Further research is required, however, to substantiate this premise. The Queensland Test seems to be an excellent test to use for assessing the intellectual ability of the deaf and hard of hearing and it would prove extremely valuable to have the Queensland normed on the deaf population in Alberta and in Canada.

Also further research on the hypothesis that the deaf child becomes more competent in certain visual-motor areas to compensate for his handicap would prove helpful to educators of the deaf. Perhaps concept formations can be taught through different modalities in the deaf and hard of hearing child.

Comparative studies would prove helpful in determining whether or not Furth (1960) is correct in assuming that the deaf child who learns to sign at a very early age will be able to acquire language at a faster rate than the deaf child who has not been taught to sign at an early age.

CHAPTER VII

IMPLICATIONS

The results of this study showed that both deaf and hard of hearing samples of children perform poorly on a verbal intelligence test. The children comprising the hard of hearing sample performed significantly better on a verbal intelligence test than did the deaf sample, although both samples performed equally well on a test measuring non-verbal ability. Speech Reception Thresholds (S.R.T.) were recorded for all the children except two within the hard of hearing sample, while no S.R.T.s were recorded for the children within the deaf sample, this being the major difference in auditory functioning between the two groups.

While collecting data for this study it became evident to the author that changes in the education of the hearing impaired must occur if the full potential of the hearing impaired child is to be realized.

The author would suggest that the following are essential if the education of the hearing impaired child is to be improved.

The hearing loss must be detected as early as possible so parental counselling and the special education of the hearing impaired child can begin immediately. Attempts to determine whether a child is hearing impaired need to begin soon after birth. The use of a High Risk Register (Mencher, 1973) would facilitate early detection of the hearing impairment. The hearing impaired child must be given advantage of amplification as soon as possible and to be given the opportunity to learn through meaningful communication with significant others regardless of whether the method used is speech, fingerspelling, signing or a combination of these. Teaching the hearing impaired baby is necessary if one ascribes to Piaget's hypothesis that a crucial age for language acquisition does exist. This age, according to Piaget is at approximately three years. In order to maximize the hearing impaired child's acquisition of language skills the child must be exposed to and taught language as soon as possible after birth. This is not an innovation when one considers that the hearing child is exposed to language from birth onward.

Extensive home training programs and parental counselling are necessary to ensure that the parents of the hearing impaired child are aware of the ways in which they can communicate with their children, thus exposing their child to language. Parents of the hearing impaired child should be clear as to the differences between communication, language and speech, and the various techniques which can be used to help the child acquire skills in these areas. Parents require counselling as to the etiology, type and degree of hearing loss their child has incurred. If their child can benefit from surgery or hearing aids detailed explanations should be given to the parents.

The best amplification equipment and auditory training procedures within our schools are imperative if the hearing impaired child is to make use of residual hearing. It was felt that few of the children used in this study made adequate use of their hearing, although the hard of hearing children did appear to make better use of residual hearing. Since the hard of hearing children were expected to use oral communication in the classroom they may have been inadvertently trained to listen. This is not to say, however, that the children within the hard of hearing sample had acquired adequate listening skills. It is interesting to note that for two children who attended Hearing Conservation classes no S.R.T.s were recorded. These two children had profound bilateral hearing losses. For the profoundly deaf child, special techniques are necessary to make use of residual hearing and supplemental forms of communication need to be employed to supply information and teach language to the child.

An effort must be made by all educators of the hearing impaired to help the child make use of residual hearing. A hearing impaired child who has acquired good listening skills may be at a significant advantage in all learning areas, but especially in the area of language and speech acquisition. Although most teachers of the hearing impaired have been involved in auditory training with their students, often this is discontinued before the child has acquired adequate listening skills. It would be ideal if schools with hearing impaired pupils could employ full time speech therapists and audiologists to ensure that the best auditory equipment is being used and maintained and that adequate auditory training and language programs are instituted. The auditory training and language programs need to include testing, program planning, teacher training and remediation.

The author has noted that in some cases the hearing impaired child who is integrated into a regular class at an early age develops a significantly better language level. It could be that the hearing impaired child who has better language tends to be integrated or that the regular classroom teacher expects more from the hearing impaired child than does the experienced teacher of the hearing impaired. The parents of the child who is integrated at an early age may tend to be more aware of the needs of their child, or the hearing impaired child may actually learn more from interacting with his hearing peers. Perhaps the hearing impaired child who is integrated in the regular classroom can practice and obtain feedback from his hearing peers and this facilitates his language development. This is not the case in a classroom of only hearing impaired children where all the youngsters experience deficits in language.

Another reason for the relative academic and social success of the child who is integrated into a regular program may be that the child can live at home. Frequently, when special programs do not exist in the child's community, parents find it necessary to place the hearing impaired child in a foster home, group home, or residence. For the child this is a traumatic experience and requires a significant adjustment. In such a setting the child's mobility is often restricted and Myklebust (1966) has found that a residential setting tends to inhibit the hearing impaired childs' ability to mature normally and to develop independence, self sufficiency and self reliance.

Thus the education of the hearing impaired might include auditory training, speech, speech reading, fingerspelling, sign language, cued speech as well as social and academic integration to enable the child to realize his potential. As every child is an individual the techniques used will depend on the needs and strengths of that child. Some educators recommend the use of Total Communication (auditory training, speech, speech reading, fingerspelling, and the language of signs), some Auralism (the use of residual hearing) and some Cued Speech (the use of various signals to represent different sounds). It is the author's conviction that the methods used must fit the individual child.

In summary, the author wishes to stress that no panacea exists for educating the hearing impaired child. As a number of professionals are involved in the diagnosis, management and education of these children a conserted effort has to be made by all those involved to coordinate and upgrade their services. The general public and particularly parents can and should exert political pressure at the local, provincial and federal levels to provide much needed facilities for the hearing impaired.

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APPENDIX A

APPENDIX A

RAW TEST SCORES OBTAINED BY THE DEAF AND HARD OF HEARING ON THE PEABODY AND QUEENSLAND

SUBJECT NUMBER	SCHOOL OR CLASS	AGE	PEABODY PICTURE VOCABULARY TEST - FORM A (Raw Score)	QUEENSLAND TEST FULL SCORE (Raw Score)	QUEENSLAND TEST SUBTEST SCORES: Knox Cubes	Beads	Passalong	Form Assembly	Pattern Arrangement
1	A.S.D.	10 - 5	38	35	10	4	5	8	8
2	H.C.	10 - 10	75	48	7	10	6	10	15
3	A.S.D.	10 - 4	16	34	6	3	3	11	11
4	H.C.	9 - 10	55	38	11	4	3	10	10
5	A.S.D.	7 - 6	22	24	3	2	3	11	5
6	H.C.	7 - 6	40	32	8	1	3	11	9
7	A.S.D.	9 - 6	23	54	10	10	7	13	14
8	H.C.	9 - 4	20	22	7	1	2	5	7
9	A.S.D.	8 - 11	44	48	10	6	5	12	15
10	H.C.	8 - 10	43	37	7	3	4	10	13
11	A.S.D.	10 - 7	38	33	10	4	3	9	7
12	H.C.	10 - 4	54	48	11	6	6	10	15
13	A.S.D.	8 - 3	36	29	8	3	4	9	5
14	H.C.	8 - 8	35	34	9	3	4	10	8
15	A.S.D.	8 - 5	21	26	7	3	3	7	6
16	H.C.	8 - 3	38	22	7	1	2	7	5
17	A.S.D.	8 - 6	41	29	8	2	3	10	6
18	H.C.	8 - 7	37	25	7	3	2	7	6
19	A.S.D.	10 - 2	40	30	9	4	2	8	7
20	H.C.	10 - 5	54	34	8	4	5	9	8

A.S.D. - Alberta School for the Deaf - Deaf Subjects

H.C. - Hearing Conservation Classes - Hard of Hearing Subjects

SUBJECT NUMBER	SCHOOL OR CLASS	AGE	PEABODY PICTURE VOCABULARY TEST - FORM A (Raw Score)	QUEENSLAND TEST FULL SCORE (Raw Score)	QUEENSLAND TEST SUBTEST SCORES: Knox Cubes	Beads	Passalong	Form Assembly	Pattern Arrangement
21	A.S.D.	11 - 1	41	33	6	5	4	9	11
22	H.C.	11 - 0	57	52	10	7	6	14	15
23	A.S.D.	9 - 0	36	37	8	5	2	10	12
24	H.C.	8 - 4	56	10	2	1	2	5	0
25	A.S.D.	9 - 4	21	43	11	7	3	10	12
26	H.C.	9 - 0	46	36	10	2	3	[illegible]	12
27	A.S.D.	7 - 8	18	39	10	4	3	11	11
28	H.C.	7 - 11	33	37	8	3	3	10	[illegible]
29	A.S.D.	9 - 1	43	44	10	5	4	11	14
30	H.C.	9 - 2	39	38	10	9	2	9	8
31	A.S.D.	11 - 5	52	48	9	8	6	10	15
32	H.C.	11 - 9	78	39	10	5	4	7	13
33	A.S.D.	6 - 10	19	28	2	3	3	11	9
34	H.C.	6 - 5	49	15	1	2	1	10	1
35	A.S.D.	10 - 11	44	36	10	3	3	11	9
36	H.C.	10 - 8	56	34	7	4	5	8	10
37	A.S.D.	11 - 11	44	47	10	4	6	14	13
38	H.C.	12 - 3	52	46	10	4	6	12	14
39	A.S.D.	12 - 1	35	36	7	1	5	[illegible]	13
40	H.C.	12 - 1	42	36	7	3	6	8	10
41	A.S.D.	10 - 3	20	43	9	8	5	7	14
42	H.C.	10 - 7	48	37	11	3	5	8	10
43	A.S.D.	12 - 2	46	48	8	6	6	14	14
44	H.C.	12 - 0	52	39	11	8	5	8	7

SUBJECT NUMBER	SCHOOL OR CLASS	AGE	PEABODY PICTURE VOCABULARY TEST - FORM A (Raw Score)	QUEENSLAND TEST FULL SCORE (Raw Score)	QUEENSLAND TEST SUBTEST SCORES: Knox Cubes	Beads	Passalong	Form Assembly	Pattern Arrangement
45	A.S.D.	10 - 3	40	43	11	6	4	9	13
46	H.C.	10 - 4	43	33	11	1	5	9	7
47	A.S.D.	8 - 9	40	42	9	8	5	8	12
48	H.C.	8 - 9	45	27	9	3	3	8	4
49	A.S.D.	11 - 6	47	36	11	3	3	12	7
50	H.C.	11 - 2	49	27	9	2	2	7	7