AN ABSTRACT OF THE THESIS OF

Sharon Schmidt for the degree of Doctor of Philosophy

in Education presented on August 7, 1981

Title: The Relationship Between Hearing Impairment and Motor Proficiency in Selected School Age Children

Abstract approved: Redacted for privacy

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The purpose of this study was to discern the relationship of variables associated with hearing impairment to motor proficiency. The study was conducted with 70 hearing impaired students from within the Salem Region of Oregon who attended public school (n=42) or the Oregon State School for the Deaf (n=28). Motor proficiency was measured by the total point score of the Bruininks-Oseretsky Test of Motor Proficiency (short form). Subjects were classified according to seven variables: age, sex, level of hearing impairment, corrected level, age of onset, etiology, and educational placement. The 14 items which comprised the eight subtests of the Bruininks-Osseretsky Test of Motor Proficiency (short form) were given to the students in the manner suggested in the test manual using total communication when necessary.

A Pearson Product-Moment correlation coefficient was established to describe the strength of the relationship between the total point score and age, hearing level, and corrected level. The significant differences between total point scores of the hearing impaired

grouped by sex and etiology were determined using the *t*-test of differences between means. To determine the significance of the difference between total point scores and each level of educational placement, the analysis of variance statistical technique was computed with the Student-Newman-Keul's procedure as the subsequent test of significance. Multiple regression analysis was then computed to determine the strength of the relationship of the significant variables to motor proficiency.

No significant relationship was found between motor proficiency and level of hearing loss or corrected level. Age was found to be significantly related to the total point scores on the motor proficiency test as expected. There were no differences in the mean total point scores between the hereditary and non-hereditary etiology groups or between the males and females suggesting that these variables did not affect total point score on this test. The analysis of variance and subsequent test indicated a significant difference in total point scores between the Oregon State School for the Deaf (OSSD) day group and both the OSSD residential group and the public school group in favor of the latter two groups. A regression equation was computed with the variables age, sex, and educational placement which identified age and educational placement as significant factors. On the basis of the findings of this study and within the limits of the investigation, the conclusion was made that there was no relationship between hearing impairment and motor proficiency.

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The Relationship Between Hearing Impairment and Motor Proficiency in Selected School Age Children

by

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A THESIS

submitted to

Oregon State University

in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Completed August 7, 1981

Commencement June 1982

APPROVED:

Redacted for privacy

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Date thesis is presented August 7, 1981

Typed by Karen Miller for Sharon Schmidt

ACKNOWLEDGEMENTS

The investigator wishes to acknowledge the members of the doctoral committee for their direct participation and guidance throughout the thesis preparation: Dr. Ruth Stiehl, Dr. Vern Dickinson, Dr. Harlan Conkey, Dr. Warren Hovland, and especially Dr. John Dunn, major advisor. Appreciation is extended to the students in the public schools and the Oregon State School for the Deaf and their parents for their enthusiastic participation in this study. Special thanks to the other members of the evaluation team whose assistance was invaluable in organizing the data gathering process: Nancy Horner, Maureen T. Casey, and Judy Clark.

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CHAPTER I

INTRODUCTION TO THE STUDY

Research on motor ability in the 1960's and 1970's defined the basic abilities which seem to underlie movement potential. Using primarily factor-analytic techniques, researchers attempted to cluster abilities into the fewest categories which would describe motor performance in the widest variety of tasks (Cratty, 1967; Doll, 1946; Flieshman, 1964; Guilford, 1958; Harrow, 1972; Rarick & Dobbins, 1972). While there are slight differences in the findings from each study, there are also categories of movement skills which show repeatedly to be a factor in proficiency of movement. By using criterion instruments which evaluate each of these areas (Bruininks, 1978; Barry & Cureton, 1961; Henry, 1962; McCloy, 1940; Oseretsky, 1948; Rarick, 1976), decisions concerning present motor functioning can be postulated. These motor ability tests or instruments which measure some aspect of motor ability, have been used to define motor characteristics and/or the affects of certain conditions on the motor characteristics of different groups.

There is no extensive research available on the motor proficiency or motor ability of the hearing impaired and deaf.

Most researchers have drawn conclusions by studying the difference between the hearing and hearing impaired. Three general conclusions have been reported: there is no significant difference in the motor ability of the hearing and hearing impaired (Boyd, 1967; Geddes, 1978; Long, 1932; Myklebust, 1954), there is a one to one and a half year delay in the motor development of the hearing impaired (Carlson, 1972; Ewing, 1957; Lubin, 1978; Myklebust, 1964; Vance, 1968), and the hearing impaired are significantly poorer in balance skills than the non-hearing impaired (Boyd, 1967; Ewing, 1957; Lindsey and O'Neal, 1976; Long, 1932; Morsh, 1938; Myklebust, 1946; Vance, 1968). As shown by the conclusions listed, there is a discrepancy in the existing research. In most of these studies, the hearing impaired and deaf are placed together in a non-definitive group. Little attempt has been made to distinquish among the hearing impaired with respect to variables which may be important. Boyd (1967), Myklebust (1966), and Pennella (1979) suggest that motor development in the hearing impaired could be better studied by controlling for etiology or severity of loss. This study investigated the variables associated with impairment of hearing with respect to motor proficiency.

Purpose of the Study

The purpose of this study was to discern the relationship between hearing impairment and motor proficiency. Seventy hearing impaired students from within the Salem Region in Oregon served as subjects. Motor proficiency was measured by the Bruininks-Oseretsky Test of Motor Proficiency (short form) with hearing impairment indicated on the basis of an audiological pure-tone evaluation. Subjects were classified according to the following variables: age, sex, level of hearing impairment, correction level, etiology of the hearing impairment, age of onset, educational placement, and motor proficiency (see definitions, p.4). Upon the basis of the findings, the investigator drew conclusions with respect to the relationship between hearing impairment and motor proficiency.

Definitions and/or Explanations of Terms

For the purpose of clarification, the following definitions and/or explanations of terms have been established for use in the study:

Hearing Impairment. Any malfunctioning of the auditory process is a hearing impairment. For the purpose of this study, a loss in functional hearing, as established by audiometric or impedance testing, identified a student as hearing impaired (Katz, 1979). All hearing testing and interpretation was performed by an audiologist certified by the American Speech and Hearing Association, licensed by the State of Oregon. Appropriate assessment procedure was determined by the audiologist depending on the age and intellectual functioning of the subject. Hearing impairment was stated as a numerical decibel (dB) loss obtained by averaging the dB loss at 500, 1000, and 2000 hertz of the better ear (pure-tone average-PTA).

Motor Proficiency. Motor proficiency is the student's present level of movement capability (Bruininks, 1978). As an indicator of present performance, motor proficiency scores are not an attempt to predict future performance. Motor proficiency was assessed in this investigation by the Bruininks-Oseretsky Test of Motor Proficiency (short form). The criterion instrument includes measures in eight subtest areas, each designed to assess an important aspect of motor development as established by the literature (Figure 1). The total point score provided is derived by adding together a common set of scale values converted from the item raw scores (Bruininks, 1978). Individual subtests are: running speed and agility, balance, bilateral coordination, strength, upper-limb coordination, response speed, visual-motor control, and upper-limb speed and dexterity. Validity of the test was established by the agreement between the behaviors assessed by the Bruininks-Oseretsky Test and the behaviors judged to be significant by the research of past investigators (Figure 1). Test-retest reliability coefficients averaged .86 for all age groups (Bruininks, 1978). The test was easily administered to individual students in approximately 20 minutes.

Bruininks-Oseretsky Subtest	Oseretsky (Doll, 1946)	Guilford (1958)	Cratty (1967)	Fleishman (1964)	Harrow (1972)	Rarick & Dobbins (1972)
Running Speed and Agility		---	---		---	---
Balance	---	---	---	---	---	---
Bilateral Coordination	---	---	---	---	---	---
Strength		---	---	---	---	---
Upper-Limb Coordination	---	---	---	---	---	---
Response Speed		---	---	---	---	
Visual-Motor Control	---	---	---		---	
Upper-Limb Speed and Dexterity	---	---	---	---	---	---

Figure 1. Relationship of the Bruininks-Oseretsky Test of Motor Proficiency content to aspects of motor development identified by various investigators. (Bruininks, 1978; reprinted by permission of the publishers, AGS, 1979)

Motor Proficiency Terms: Static balance. The ability to maintain body equilibrium while holding a stationary position. Performance balance. The ability to maintain body equilibrium while moving. Bilateral coordination. The ability to coordinate the feet and hands in simultaneous or sequential movement patterns. Upper-limb coordination. The ability to coordinate visual tracking with movements of the arms and hands. Response speed. The ability to react and respond to a moving visual stimulus. Visual-motor control. The ability to coordinate precise hand and visual movements. (Bruininks, 1978)

Correction Level. The correction level refers to the level of hearing loss (PTA) identified by audiometric testing while the subjects' hearing aid(s) was being worn. It was assumed that the aid(s) was identified by the audiologist as working and set at the appropriate level during testing.

Etiology of Hearing Impairment. Three categories were used to identify and classify the etiology (cause) of the hearing impairment: hereditary, non-hereditary, and unknown.
A hereditary loss is a profound, irreversible, bilateral sensorineural hearing loss of early onset (Northern & Downs, 1978). According to Northern & Downs (1978), most patients with hereditary deafness have intact and functional vestibular systems. The hereditary classification is an attempt to separate genetic factors from exogenous factors (outside the system) which were classified

as non-hereditary.

Age of Onset. Subjects were placed into one of three categories relating to the age of onset of the hearing impairment: pre-age two, post-age two, and unknown. Reports in the literature support the existence of a pre-linguistic separation for possible affects of hearing impairment on language acquition (Northern & Downs, 1978). Even a short exposure to language gives a child some foundation on which language can be based. The relationship of this variable to motor proficiency is undetermined at this time.

Educational Placement. In order to make some statements relating to appropriate placement within the options offered by the Oregon school system, the educational placement of the students was recorded and studied. One of six categories was used: full-time residential school for the deaf, full-time day student at the school for the deaf, one-half residential and one-half day public school, public school full-time, transition into public school, and transition out of public school. A student was considered in transition if a change was made within two school years, i.e., 1979-80 or 1980-81 school years.

Total Communication. The systematic simultaneous use of speech/speech-reading and signs/finger-spelling supported by the printed word plus all other media (Oregon Task Force on Total Communication, 1972).

Statement of the Problem

The general problem of this study was to examine the following null hypothesis: There is no relationship between motor proficiency, as measured by the Bruininks-Oseretsky Test of Motor Proficiency, and hearing impairment. Several sub-hypotheses were studied to assist in the analysis of the final null hypothesis:

1. There is no difference between hereditary and non-hereditary deafness with respect to motor proficiency scores.
2. There is no relationship between the level of hearing impairment and motor proficiency.
3. There is no relationship between the corrected level of hearing and motor proficiency.
4. There is no difference between the means of the motor proficiency scores of the hearing impaired grouped by age of onset of the impairment.
5. There are no differences among the motor proficiency scores of the hearing impaired grouped by educational placement.
6. There is no relationship between the age of the hearing impaired and motor proficiency.
7. There is no difference between male and female hearing impaired with respect to motor proficiency.

Deliminations of the Study

The study was delimited to 70 hearing impaired students from within the 19 counties of Oregon that comprise the Salem Regional Program for the Deaf. The Bruininks-Oseretsky Test of Motor Proficiency (short form) was used as the criterion measure of motor proficiency. Audiological evaluations were administered by a licensed audiologist.

Limitations of the Study

The study was subject to the following limitations:

1. The reliability, validity, and objectivity of the Bruininks-Oseretsky Test of Motor Proficiency (short form) to measure motor proficiency.
2. The reliability, validity, and objectivity of the audiological pure-tone evaluation.
3. The accuracy of the information obtained from the parent information and school information forms.
4. The extent that the affect of prior physical education programming, or lack of it, may have had on motor proficiency scores.
5. The degree to which external factors such as motivation, clothes, shoes, diet, and prior exercise were controlled.

6. The extent to which this sample was representative of the hearing impaired population within the boundaries of the Salem Regional Program for the Deaf.

CHAPTER II

REVIEW OF RELATED LITERATURE

Presented in this chapter is a comprehensive review of the research available on the motor ability of the hearing impaired and deaf. The chapter is divided into four major areas pertaining to motor proficiency: balance, motor development, motor ability, and fine motor skills. These four sub-headings provided a basis for categorizing each study.

Balance of the Hearing Impaired

Much of the research studying the affects of a hearing impairment on motor proficiency focuses on some aspect of balance or equilibrium. The impetus for this focus on balance was from Long's (1932) study of 37 deaf boys and 51 deaf girls, eight to twelve years old, matched with hearing youngsters. All subjects were given five tests of the Standford Motor Skills Test, a dynamometer test, and a test on the balance board. No significant differences were noted in fine motor skills or strength dynamometer scores. Significance was found, however, in the balance skills with the hearing subjects performing better than the deaf subjects. Long noted that deaf boys scored better than deaf girls.

Follow-up research was done by Morsh (1936) to compare deaf and hearing subjects on balance and various fine motor tasks.

Thirty-nine hearing students and twenty eight deaf students from the Columbia Institution for the Deaf, 11 to 20 years old, were tested on balance, tapping ability, steadiness, seeing versus blind performance, location memory, and speed of eye movement. Subjects were also given the Porteus Maze Test, Goodenough Drawing Test, Pinter-Paterson Performance Scale, and the Johnson Eye-Hand Coordination Test. Results indicated that the deaf were superior on steadiness and location memory and inferior on tapping, blindfolded performance and balance. Morsh concluded that there was no significant difference between the hearing and deaf in fine motor skills and that the hearing impaired were significantly poorer on balance skills than the normal hearing subjects.

In the two previous studies (Long, 1932; Morsh, 1936) the deaf were grouped together and compared to the normal hearing youngster. Myklebust (1946) classified 203 deaf students from the New Jersey School for the Deaf into one of five groups, according to etiology: endogenous, presumably endogenous, exogenous, meningitis, and undetermined. Subjects were given the Heath Railwalking Test to measure locomotor coordination and balance ability. The deaf girls were significantly poorer than the deaf boys and the meningitis group was significantly inferior to the other groups. Myklebust hypothesized that the inferior motor performance by the meningitis group was due to the non-functioning semi-circular canals rather than the loss of hearing.

Further control for variables possibly affecting balance was investigated by Boyd (1967), Lindsey and O'Neal (1976), and Logan (1969). Boyd intended to compare hearing and deaf boys on measures of static balance, locomotor coordination, psychomotor integration, and laterality. The 90 deaf boys used as subjects from Canadian and United States residential schools were in three etiological groups: a) pre- or paranatal, exogenous (n=30); b) hereditary, endogenous (n=30); and c) exogenous, postnatally deaf (n=30). The mean level of impairment ranged from 80 to 90dB in the better ear indicating all subjects were severely impaired with no significant differences in hearing among the three groups. No subjects were accepted with an additional handicapping condition The control group consisted of hearing subjects matched according to age, sex, and IQ.

The analysis of variance statistical technique was used to compute the differences between variances with respect to each area measure and to age, etiology, and control groups. Results for control group and deaf group were: 1) a significant difference on the static equilibrium test in favor of the hearing, 2) no significant difference between eight year olds with respect to locomotor coordination but an increasingly significant difference among the nine and ten year old impaired group and the control group, 3) no significant difference with respect to measures of psychomotor integration, and 4) no significant difference on the measures of speed of motor function.

Boyd reported results in opposition to Myklebust concerning etiology and balance. There was no significant difference reported in equilibrium as well as locomotor coordination or measures of psychomotor interaction. The only significant differences among etiology groups was with respect to speed of movement. A trend was identified in this study, which will be discussed in a later part of this chapter, suggesting that the endogenous, hereditary deaf displayed a growth pattern in the manner similar to the hearing while the prenatal deaf showed a poorer level of performance and rate of development.

One of the most extensive studies concerning the question of balance skills of hearing impaired and normal children was done in 1976 by Lindsey and O'Neal. Although etiology was not a classification, level of impairment, race, and sex were controlled. The hearing impaired subjects for the study were 31, eight year old boys and girls from two residential deaf schools in North Carolina with 65dB or greater hearing loss. Seventy-seven hearing boys and girls (eight years old) from two public schools in North Carolina were selected as the comparative group. Subjects were asked to perform 16 tasks selected from test batteries previously published which measured either static or dynamic balance. Tests were administered by an examiner and a recorder; when testing hearing impaired students, an interpreter was used to ensure complete understanding of each test. Data were analyzed using the analysis of variance technique to compare the deaf and hearing children on the balance tasks.

Results were reported as three major conclusions: 1) deaf youngsters exhibited poorer static balance skills than hearing youngsters, 2) deaf youngsters exhibited poorer dynamic balance skills than hearing youngsters, and 3) there were no significant effects for race or sex on the performance of static or dynamic balance skills in all of the eight year olds. The first two results are in agreement with the other comparative balance studies.

The investigators suggested that more studies are needed to clarify the effects of deafness on motor function. It was suggested that related studies start with identifying age and possibly sex appropriate screening devices that are reliable for use with the hearing impaired. After using appropriate tools and measuring motor characteristics of the hearing impaired, experimental studies could be designed to help answer how to best reduce potential motor and balance deficits. Lindsey and O'Neal also stated that one variable not controlled in their study which may have influenced results was the factor of educational placement; the hearing subjects were from public schools and the hearing impaired subjects were from residential schools for the deaf.

Another aspect of balance of the hearing impaired was studied by Logan (1969). She used 60 hearing impaired and 60 hearing subjects at elementary and college levels to compare static and dynamic equilibrium with two diverse age groups. The hearing impaired subjects at the elementary level exhibited significantly poorer balance ability than the hearing elementary subjects. This finding was in agreement with previous research. At the college level, however, differences were found to be significant in only three of the six tests administered. She hypothesized that by college age some sort of compensatory skills were learned by the hearing impaired.

Motor Development of the Hearing Impaired

Several researchers alluded to the possible relationship of age and hearing impairment with motor ability. Boyd (1967) reported no significant differences with respect to locomotor coordination between eight year old hearing and hearing impaired but an increasingly significant difference between the nine and ten year old hearing impaired and the control group. Logan (1969) noted differences in balance at the elementary level in favor of the hearing but not at the college level. The relationship of age and the motor development or motor ability of the deaf was the main purpose of four different studies beginning with Myklebust (1954). He compared the sitting and walking ages for normal (n=60), aphasic (n=60), emotionally disturbed (n=27), mentally retarded (n=27) and deaf (n=73) subjects ranging in age from six to twenty-two months. Myklebust found no significant differences between the deaf and normal children with respect to the selected motor development landmarks when the factor of intelligence was controlled.

Results reported by Ewing (1957) were not in agreement with Myklebust. Ewing selected 180 deaf and 180 hearing children age 18 to 65 months, to serve as subjects for a study of motor skills of the deaf. All subjects were rated with the Merrill-Palmer Scale, the Atkins Object Fitting Test, and the Bowly Motor Development Scale. No significant differences between the hearing and deaf were reported in fine motor skills and significant differences were found in balance skills on the Gesell walking board. Relating to motor development, small but significant differences were reported in gross motor skills with the profoundly and severely impaired deaf children sitting and walking later than the partially deaf or normal.

Motor development profiles on eleven deaf and hard-of-hearing preschool children enrolled in the John Tracy Clinic were developed by Geddes (1978). Four boys and seven girls, ranging in age from four years to five years, six months, were used as subjects. Seven subjects were classified profoundly deaf, two severely deaf, and two hard-of-hearing. Subjects were evaluated on portions of the Geddes Psychomotor Inventory and data were taken from observations during free play and parent and teacher reports. The mode of communication used throughout the testing was oral-aural.

The investigator reported that, while some performances were above age level and some below, essentially all subjects were at age level. Four of the eleven subjects had poorer balance skills and two of the eleven were judged to exhibit poorer throwing skills. In the five to six year old group, all subjects performed within the age range with the exception of two below level balance performances. The results agree with Myklebust's results that the deaf develop essentially along normal lines relative to motor development.

Carlson (1972) partially supported Myklebust and Geddes in his study conducted to assess the gross motor ability of primary school-aged deaf children while looking at the affects of age, sex, and residual hearing. Forty-eight students in the primary grades of the Kansas State School for the Deaf were used as subjects. The mean age was 8.18 years and hearing levels ranged from 40 to 110dB with an average PTA of 89dB. Graduate students in physical education administered the Brace Motor Ability Test to all subjects utilizing demonstration only.

The *t*-test for significant differences was used to test the differences between the variables. No significant differences were found between boys and girls or between groups divided for hearing loss (I=100dB; II=80-100dB; III=less than 80dB). The researcher suggested that intensity of loss did not affect motor behavior. Five and six year olds grouped together did score significantly lower than seven and ten year olds grouped together suggesting that there is some improved performance with age. The lack of significant differences, however, between the age groups above seven suggested that motor development may not increase after age seven in the hearing impaired.

Evidence was available from the literature, to suggest that at young ages the hearing impaired develop at essentially normal rates. This development may slow after seven years of age with no significant maturation in motor development.

Motor Ability of the Hearing Impaired

Many of the same studies which assessed balance skills included other measures of motor ability or motor proficiency. Strength was measured by Long (1932) with no significant difference found between hearing impaired and hearing subjects. Boyd (1967) included measures of locomotor coordination and psychomotor integration in his study. No significant differences between hearing and hearing impaired were found with respect to measures of psychomotor integration although the previously noted differences in locomotor coordination were found in favor of the hearing nine and ten year olds. The differences could not be attributed to etiology in Boyd's study.

The motor abilities of 30 boys and 20 girls, eight through fourteen years of age, enrolled at a public residential school for the deaf were measured by Myklebust (1964). Subjects were given the Oseretsky Test of Motor Performance which measured six areas of motor function: dynamic manual, general static, general dynamic, speed, siultaneous movement, and synkinesia. This test was standardized by age level with the scores derived in terms of motor age. The deaf were found to be within a normal range in dynamic manual (ability to use hands while body is in motion) and synkinesia (overflow). Delays were found in the other four areas reported highest to lowest as: general dynamic (total body coordination), simultaneous movement (of parts of the body), general static (ability to use and maintain balance), and speed (rate of motor performance). Myklebust concluded that the hearing impaired children fell approximately one and one-half years below the norm provided by Oseretsky for the hearing children.

Vance (1968) conducted a study to compare the performance of deaf children with non-deaf children on a variety of motor skills. Deaf children (65dB loss or greater) without intellectual and physical impairments were matched with non-deaf children by chronological age and sex. Forty-four deaf children in the experimental group and forty-four hearing children in the control group were divided into four levels by chronological age spans of two years beginning with five years of age. For each age level, the number of girls (six hearing and six deaf) and the number of boys (five hearing and five deaf) were the same.

All subjects were asked to perform ten motor tasks. The criterion measures were: hand dynamometer, grip strength, balancing on one foot, the Burpee squat thrust, ball throw at a target, the Sargent jump, zig-zig run, the 50-yard dash, and three sub-tests of the MacQuarrie Test for Mechanical Ability: tracing ability, tapping speed, and dotting speed. The data were treated with a treatment by levels analysis of variance to compare the initial performance on the ten motor tasks.

Two findings were reported in the study: 1) normal hearing boys achieved higher raw scores than the deaf boys on all ten items and significantly higher (.05) on six out of ten items, and 2) normal hearing girls recorded higher scores on nine out of ten items and significantly higher (.05) on two out of ten items. The reported conclusion of the study is in agreement with Myklebust that normal hearing children are superior to deaf children on a variety of motor tasks. No attempt was made in either of these studies to identify any possible affect of etiology on the motor performance.

Fine Motor Skills of the Hearing Impaired

Measures of fine motor function were included in many of the previously reported studies. Inferior skills relating to the motor speed of the hearing impaired were reported by Morsh (1936), Myklebust (1964), and Vance (1968). Conversely, no significant differences were found in fine motor skills, including speed of movement by Long (1932), Boyd (1967), and Ewing (1957). The reaction time and movement time of deaf and hearing freshman male college students were compared by Minter (1969). Fifty deaf Gallaudet College students and fifty hearing students from Catholic University were tested on two tasks. No significant differences were reported on the simple reaction time test requiring the depression of a telegraph key at a visual stimulus. On a complex reaction and movement task requiring the extinguishing of ten lights in random sequence, the deaf were found significantly (.01) superior.

While there is some difficulty in seperating the findings in the literature with respect to fine motor skills and speed of movement, there seems to be a partial agreement that the hearing impaired are not significantly different with respect to any fine motor skills except speed of movement.

Summary

Three authors have published articles in various professional journals concerning the motor abilities of the deaf. These articles are important, even though they are not classified as research, because through these articles many educators gather "facts" with which to design programs. In "The Deaf Student in Physical Education", Berges (1969) listed certain physical characteristics which the deaf may exhibit. Those characteristics relating to motor ability were: "His balance may be poorer, his lung capacity may be underdeveloped...(and) he may show somewhat superior hand steadiness and control." (Berges, 1969) Berges suggested program adaptations that may be necessary when a deaf student participates in physical education. The strongest of these suggestions was that the deaf student is likely to have poor balance.

In an article designed to encourage abstract thinking in the hearing impaired through dance, Wisher (1969) made two statements relative to motor ability and the deaf. Where deafness occurs with impairment of the vestibular organs, balance is likely to be affected. Poor balance, in a sense of total body response, however, was not observed by Wisher to be a problem with the dancers enrolled at Galluadet.

Pennella (1979) reported on the implications of research about motor ability and the deaf in an attempt to give direction to curriculum planning. He summarized what had been stated in the literature about the deaf and motor ability: 1) balance may be affected depending on the etiology of the impairment, and 2) motor ability in general may be affected depending on the etiology of the impairment. Pennella suggested further research which better controlled for etiology using one of four categories: 1) hereditary (endogenous), 2) post-natal (exogenous), 3) pre-natal-rubella (exogenous), and 4) undetermined etiology. Research relative to improving balance was also suggested.

The literature concerning the motor ability of the hearing impaired and deaf is relatively general and non-descriptive. In an effort to better comprehend the results from the studies presented, two charts are offered in this summary. Table I lists the thirteen studies from the literature under the four major areas pertaining to motor proficiency. All seven researchers who studied some aspect of balance concluded that the deaf or hearing impaired were significantly inferior to the hearing. Of the six studies related to motor development, four reported significant differences in the rate of motor development in favor of the hearing and two found no significant differences. Four researchers investigated motor ability in general with two finding significant differences in favor of the hearing and two finding no significant differences. Seven studies reported results pertaining to fine motor skills with three consluding no significant differences, three reporting significant differences in motor speed, and one finding the deaf superior in motor speed.

TABLE I

MAJOR AREAS IN THE LITERATURE OF MOTOR PROFICIENCY OF THE DEAF

Balance		Motor Development		Motor Ability		Fine Motor	
Long	S[a]	Boyd	S	Long	NS	Morsh	S
Morsh	S	Logan	S	Boyd	NS	Myklebust (1964)	S
Myklebust (1946)	S	Myklebust (1954)	NS[b]	Myklebust (1964)	S	Vance	S
Ewing	S	Ewing	S	Vance	S	Long	NS
Boyd	S	Geddes	NS			Boyd	NS
Lindsey & O'Neal	S	Carlson	S			Ewing	NS
Logan	S					Minter	S[c]

[a]significant difference in favor of hearing
[b]no significant difference
[c]significant difference in favor of hearing impaired

Questions have been raised by Pennella, Myklebust, and others regarding the appropriateness of studying the hearing impaired without controlling for variables associated with hearing loss. Table II shows those studies which have included at least some of those variables. Etiology of the hearing loss was considered in two of the eleven studies and was found to be a probable factor with regard to balance performance and a possible factor in speed of movement differences. Two investigators studied the relationship of age and motor development and both suggested that the difference between hearing and hearing impaired increases with age. Significant differences were found between hearing impaired boys and girls in two of the four studies which considered sex as a variable. The intensity of the hearing loss was a significant factor in one of two investigations.

TABLE II

VARIABLES ASSOCIATED WITH HEARING IMPAIRMENT AND MOTOR PROFICIENCY

Etiology		Age		Sex		Intensity	
Myklebust(1946) meningitis	S[a]	Carlson	S	Lindsey & O'Neal	NS[b]	Carlson	NS
Boyd - speed of movement	S	Boyd	S	Long(boys)	S	Ewing	S
				Myklebust (1946)boys	S		
				Carlson	NS		

[a] significant factor
[b] not a significant factor

Table II shows the discrepancies in previous research concerning those variables associated with hearing impairment and motor ability. Apparent also is the lack of control for all the possible variables such as residential school setting versus public school, corrected level of impairment and/or age of onset. Previous research has failed to adequately or appropriately describe the hearing impaired with respect to motor characteristics. The affect of an impairment of hearing on motor proficiency cannot be effectively determined because comparative studies have attempted to find differences between the hearing and hearing impaired before descriptions of the population have provided those variables which may relate to the question.

CHAPTER III

METHODS AND PROCEDURES

The problem of the present study was to discern the relationship between variables associated with impairment of hearing and motor proficiency as measured by the Bruininks-Oseretsky Test of Motor Proficiency (short form). The study was conducted with hearing impaired students from within the Salem Region of Oregon who attended public schools or the Oregon State School for the Deaf. In this chapter, the methods and procedures used in the study are presented in the following sections: preliminary procedures, selection of instrument, selection of subjects, collection of data, analysis of data, and preparation of final written report.

Preliminary Procedures

The investigator surveyed, studied, and assimilated the available literature related to all aspects of the study. From this information, a thesis proposal was developed and presented to the thesis committee. Permission was secured from the committee to conduct the study during the 1980-81 academic school year. The thesis title was filed in the Graduate School Office of Oregon State University in the Winter Term, 1981. Permission was also secured for subject participation from the Research Committee of the Oregon State School for the Deaf and each of the parents of the subjects in the public schools (Appendix A). Correct procedures were followed in accordance with guidelines prescribed by the Oregon State University, Human Subjects Committee (Appendix B).

Selection of Instrument

The Bruininks-Oseretsky Test of Motor Proficiency (short form) was selected as the criterion instrument to measure motor proficiency on the basis of its reported validity, reliability, objectivity, and administrative feasibility (see definitions). A brief description of the eight subtests is presented:

1. Running Speed and Agility. This ability was measured by having the subject run 15 yards, pick up a block, and run 15 yards back to the starting line.

2. Balance. A one and one-half inch balance beam was used to measure balance skills. The subject stood on one leg for up to ten seconds to measure static balance, and walked down the beam touching heel to toe to indicate performance balance ability.

3. Bilateral Coordination. This area was tested by performance on two tasks which required the coordination of the hands and feet in simultaneous movement. The subject was asked to clap both hands as many times as possible in the air during a jump, and then to tap the feet alternately while making circles with the fingers.

4. Strength. The standing broad jump was the measure which was considered representative of overall body strength. Standing behind a tape line, the subject jumped with both feet simultaneously as far forward as possible.

5. Upper-Limb Coordination. Specific criteria were used while throwing and catching a tennis ball to assess the students ability to use the upper body and eyes in coordination.

6. Response Speed. Response speed was measured by having the subject react to a visual cue and stop a falling stick with the thumb.

7. Visual-Motor Control. Copying two shapes with a pencil and drawing a line between two other lines were the measures of visual-motor control.

8. Upper-Limb Speed and Dexterity. The subject was timed while dealing cards into one of two piles and making pencil dots in circles to measure upper-limb speed and dexterity.

Because no research was reported in the literature on the use of the Bruininks-Oseretsky Test of Motor Proficiency with the hearing impaired population, a prestudy was undertaken to ascertain the test's reliability with the adaptations necessary for the hearing impaired. Twenty-eight students randomly selected from the Oregon State School for the Deaf, were given the Bruininks-Oseretsky Test of Motor Proficiency (short form) twice within a six day period. The time between tests varied from two to six days. Directions were given using total communication in the same manner as the testing of all subjects in the major research project.

A study of Table III reveals the test-retest coefficient of reliability to be .978 between the first and second testing periods. This is higher than the coefficient reported by Bruininks (1978). This finding was attributed to the reduction in variables in this study, specifically only one investigator and only one testing site was used. The high reliability coefficient obtained using total communication is an indication of the adaptability of the Bruininks-Oseretsky Test of Motor Proficiency with the hearing impaired. Variations in scores, then, were unlikely to be attributed to any instability in the criterion instrument used with the hearing impaired.

TABLE III

TEST-RETEST RELIABILITY COEFFICIENT FOR SHORT FORM WITH TPS (TOTAL POINT SCORES)*

	n	Range TPS	Mean	SD	SEm	r
First Test	28	18-82	56.14	16.79	3.17	.978
Second Test	28	23-82	57.71	15.93	3.01	

Selection of Subjects

The subjects for the study were 42 hearing impaired students from the public schools within the 19 counties served by the Salem Regional Program for the Deaf and 28 students from the

Oregon State School for the Deaf. The Salem Regional Program for the deaf is one of four regional programs serving the hearing impaired in the state of Oregon. The map in Figure 2 shows the 19 counties within the Salem Region as well as the number of hearing impaired students attending public schools within each county. The Salem Regional Program assists 242 public school hearing impaired students, which represents 29 percent of the total 822 public school students served by regional programs for the deaf in Oregon (see Table IV).

TABLE IV

PUBLIC SCHOOL HEARING IMPAIRED STUDENTS IN OREGON
SERVED BY REGIONAL PROGRAMS

	students	%	counties
Portland Region	362	44	9
Salem Region	242	29	19
Eugene Region	95	12	1
Southern Oregon Region	123	15	7
Total	822	100	36

The Oregon State School for the Deaf, located in Marion County, has a total of 121 students whose local school districts are within the boundaries of the Salem Regional Program. The Oregon State School for the Deaf students (121) and the public school students (242) equal a total of 363 hearing impaired students educated by districts within the 19 counties of the Program.

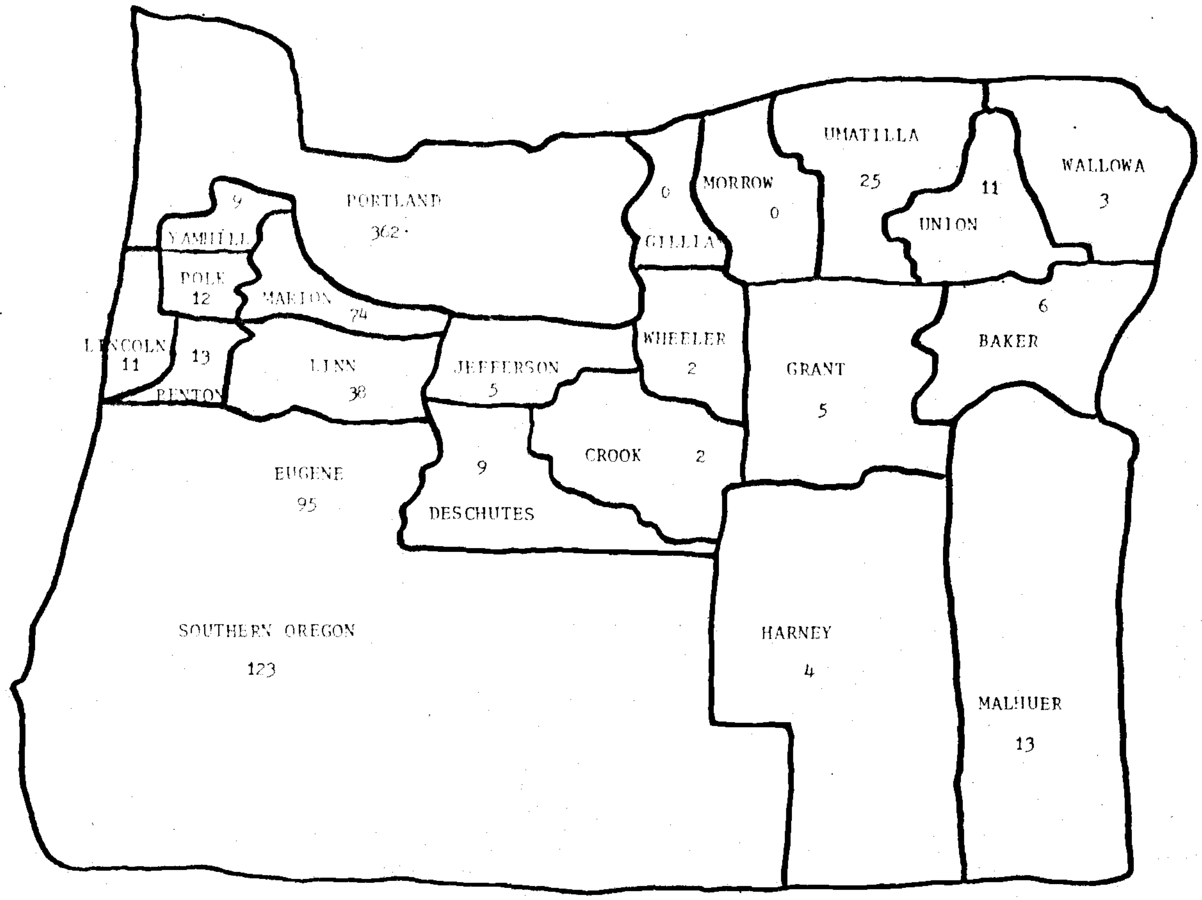


Figure 2. Counties within Salem Regional Program with number of hearing impaired students attending public schools.

Because of the large geographic area, random sampling from the total 19 counties was administratively unfeasible. A forced random sampling technique was used, therefore, to select ten counties which are identified in Table V. The two major population counties of Marion and Linn were included in the random selection. (Neter, et al. 1973)

TABLE V

ALLOCATION OF HEARING IMPAIRED SUBJECTS

Selected Counties	%	Number in Study
Baker	3	1
Crook	1	1
Deschutes	4	3
Harney	1	1
Jefferson	1	1
Linn	14	9
Marion	24	17
Polk	4	3
Union	4	3
Yamhill	4	3
OSSD	40	28
Total	100	70

The number of subjects selected from each of the ten counties and the Oregon State School for the Deaf were porportionate to the percentage of hearing impaired students that a county or the school had to the total amount of hearing impaired students within the region. Table V is a description of the allocation of subjects that were used in the study. If more subjects than required were available from a county, the needed numbers were randomly selected. The 28 subjects from the Oregon State School for the Deaf were selected from the 121 total students using the table of random numbers.

No student with an identifiable physical or mental handicap other than hearing impairment was included as a subject in this study. Background information needed to ascertain the existence of additional handicapping conditions of each public school student was acquired from the Salem Regional Program School Information Form and Parent Information Form (Appendix C). Medical records, interpreted by the school nurse, were used to acquire information about the subjects attending the Oregon State School for the Deaf. An intellectual handicap was established with the public school subjects using the performance scale of the Weschler Intelligence Scale for Children-Revised (WISC-R) given by the educational psychologist of the Salem Regional Program for the Deaf. Scores from the performance scale of the WISC-R or the Leiter Test of Intellectual Functioning taken from school records, were used to indicate an additional mental handicapping condition with the subjects who attended the Oregon State School for the Deaf.

Collection of Data

Public school students were seen in their school building during the visit of the evaluation team of the Salem Regional Program for the Deaf. The area used for testing was suggested by local school personnel in consultation with the investigator. Subjects attending the Oregon State School for the Deaf were tested in an empty wing of the campus infirmary. All of the testing areas had at least the minimum space suggested by the instruction manual of the Bruininks-Oseretsky Test. The shuttle run required an area approximately twenty-five yards long and five yards wide with a surface sufficient for sprinting. The other subtests were completed in a room at least ten square yards furnished with a table and two chairs. The test equipment was included in the Bruininks-Oseretsky Test Kit, published by the American Guidance Company and provided by the Salem Regional Program.

All tests were given by the investigator to each subject individually. Students were tested in the clothes that they wore to school the day of testing. An effort was made to standardize the type of footwear used. Test instructions were presented orally and with demonstration in the manner suggested in the test manual and simultaneously signed when needed. Because the investigator felt that the criterion measure was a test of motor proficiency rather than any attempt to measure the language level of the child, every opportunity was taken to assure that the young, severely and profoundly impaired subjects understood the task they were expected to perform. With a few students this made it necessary to adapt some of the specifically stated instructions in the manual. This change was consistent with the intent of the test design and insured that the test measured motor proficiency rather than language ability. A very important research tool for use in this study was the investigator's ability to use total communication while testing severely and profoundly hearing impaired subjects. The signing skills of the investigator met the criteria established by the Oregon State School for the Deaf and Oregon State University (Appendix D).

The 14 items which comprise the eight subtests were given in the following order: drawing a line through a straight path, copying a circle, copying overlapping pencils, making dots in circles, card sorting, response speed, throwing a ball at a target, catching a ball, tapping feet alternately while making circles with the fingers, jumping up and clapping hands, standing broad jump, static balance, dynamic balance, and running speed and agility. Total testing time for completing all test items was approximately 20 minutes for one student. Subjects were tested during the Winter and Spring of 1981.

The information necessary to determine status of the seven variables associated with hearing impairment was gathered in the following manner: A Parent Information Form (Appendix C) was sent to the parents or legal guardians by the Regional Program Office prior to the visit of the evaluation team. This form provided information, interpreted by the audiologist, pertaining to the age of onset of the hearing loss and the etiology of the impairment as well as the age and sex of the student. Audiological information for level of impairment and corrected level was provided by the Salem Regional Program for the Deaf Audiologist, certified by the American Speech and Hearing Association, and licensed by the State of Oregon. The audiologist provided what was considered an accurate reflection of the students current hearing level with and without hearing aids. Educational placement was determined by using the information from the School Information Form (Appendix C) and official school files to identify previous schools attended.

Analysis of the Data

Upon completion of the testing of all subjects, the total point score from the Bruininks-Oseretsky Test of Motor Proficiency (short form) and the seven other variable measures were coded for use in the computer utilizing the Fortran Coding Form (Appendix E). The data were run at the Oregon State University Computer Center with the Statistical Package for the Social Sciences (SPSS) Program. Distributional characteristics for each of the variables under investigation were examined. A one-way analysis of variance was computed to determine the significance of the difference between the total point scores and each level of educational placement. The significant differences between the total point score and the variables of sex and etiology were identified using the *t*-test of significance. A correlation coefficient was established to describe the strength of the relationship between the total point score and age, hearing level, and corrected level. A multiple regression equation was then computed to enable the researcher to determine the strength of the relationship of the significant variables to motor proficiency while eliminating the affects of the other variables.

Preparation of the Final Written Report

The data were summarized and a conclusion was drawn based upon the findings of the study. A written report of the study was submitted to the thesis committee in partial fullfillment of the Doctor of Philosophy degree at Oregon State University.

CHAPTER IV

PRESENTATION AND DISCUSSION OF THE FINDINGS

The purpose of the study was to discern the relationship between hearing impairment and motor proficiency. Motor proficiency was measured on 70 hearing impaired students from within the Salem Regional Program for the Deaf in Oregon using the Bruininks-Oseretsky Test of Motor Proficiency (short form). Subjects were classified according to seven variables: age, sex, level of hearing impairment, correction level, etiology of the hearing impairment, age of onset, and educational placement. Data were then subjected to statistical analyses to determine relationships between and among variables associated with hearing impairment and motor proficiency . Presented in this chapter are the descriptions of the subjects according to each variable, and the statistical analyses calculated from the data obtained from the subjects relative to the sub-hypotheses.

Description of Subjects

This section describes the basic distributional characteristics of each of the variables used in the analysis. Table VI is a description of the 70 subjects with respect to the hearing level in decibel (dB) of loss. The sample group ranged in dB loss from 20 to 113 with a mean loss of 74.23 dB. The standard deviation (SD) of 30.48 shows the data to be slightly dispersed about the mean (within ±2 SD of the mean). This group exhibits a somewhat flat distribution with a slightly negative skewness indicating relatively even grouping about the mean with no extreme values.

TABLE VI

DESCRIPTION OF HEARING LEVEL (dB)

N	range	$\bar{X}$	SD	SEm	kurtosis	Sk
70	20-113	74.23	30.48	3.64	-1.46	-.36

A description of the subjects with respect to total point score (TPS) accumulated from the Motor Proficiency Test is summarized in Table VII. The group sampled ranged in total point scores from 18 to 87 with a mean TPS of 57.70. The scores are moderately (± 3 SD) dispersed around the mean as evidenced by the SD of 15.14. Skewness and kurtosis statistics show the curve developed by the scores to be relatively normal although slightly negative with no extreme scores.

TABLE VII

DESCRIPTION OF TOTAL POINT SCORES

N	range[a]	$\bar{X}$	SD	SEm	kurtoses	Sk
70	18-87	57.70	15.14	1.81	.49	-.75

[a]maximum score was 99

Descriptive statistics for the age of the subjects are presented in Table VIII. The 70 subjects ranged in age from 72 months to 240 months with a mean age of 142.83 months. The group had a positively skewed distribution signifying that more students were below the average age than above with one extreme age at the upper end of the group. A standard deviation (SD) of 39.04 for age with a range of 168 months indicated that the group was moderately dispersed about the mean ($\pm$3 SD of the mean).

TABLE VIII

DESCRIPTION OF AGE

n	range	$\bar{\bar{X}}$	SD	SEm
70	72-240	142.83	39.04	4.67

Table IX reveals the numbers of subjects grouped according to the variables of sex, etiology, onset age of the hearing impairment, and educational placement. All subgroups provided the number of students necessary for statistical analyses with the exception of the onset age category. Because only two subjects were classified with onset age of post-age two, it was statistically inappropriate to utilize this variable. Results, therefore, will not be reported in conjunction with the onset age variable. Onset age was selected as a variable for the study because of its relation to language skills. There is no suggestion in the literature that this variable would relate to motor proficiency and, while the inability to include an analysis is disappointing, the value of this study is not believed to be compromised. Only four categories within educational placement were used in the final analysis of this variable because of the few students in the categories of half-day students and transition out of public school.

TABLE IX

NUMBERS OF SUBJECTS FOR SELECTED VARIABLES

Sex	Etiology	Onset Age	Educational Placement
36 males	10 hereditary	55 pre-age two	35 public school
34 females	30 non hereditary	2 post-age two	1 half-day OSSD/ half-day public
	30 unknown	13 unknown	11 OSSD day
			17 OSSD residential
			6 transition into public

Findings with Respect to Variables

Level of Hearing Impairment

To determine the relationship between hearing level and motor proficiency, a Pearson Product-Moment correlation coefficient was calculated. A study of Table X shows a correlation coefficient of .003 which implies very little relationship between these two

TABLE X

RELATIONSHIP OF TPS TO HEARING LEVEL

	$\overline{X}$	SD	r	r^2
TPS	57.70	15.14	.003	.000009
Hearing Level	74.23	30.48		

variables. The scattergram in Figure 3 visually represents this lack of relationship. Almost no percentage of the TPS variance was accounted for within the common factors of the two variables (r^2=.000009). The dB level of hearing impairment was not a factor in performance on the motor proficiency test.

Corrected Level

Figure 4 shows a scattergram and the results of a Pearson Product-Moment correlation calculated to find the strength and direction of the relationship between the corrected hearing level and TPS. Thirty-seven subjects qualified for this aspect of the study. The correlation coefficient of .12 established almost no relationship between the corrected hearing level of impairment and TPS. Approximately 1.4 percent of the variance in TPS was due to common factors of the two variables. Performance on the motor proficiency test did not appear related to the corrected level of impairment.

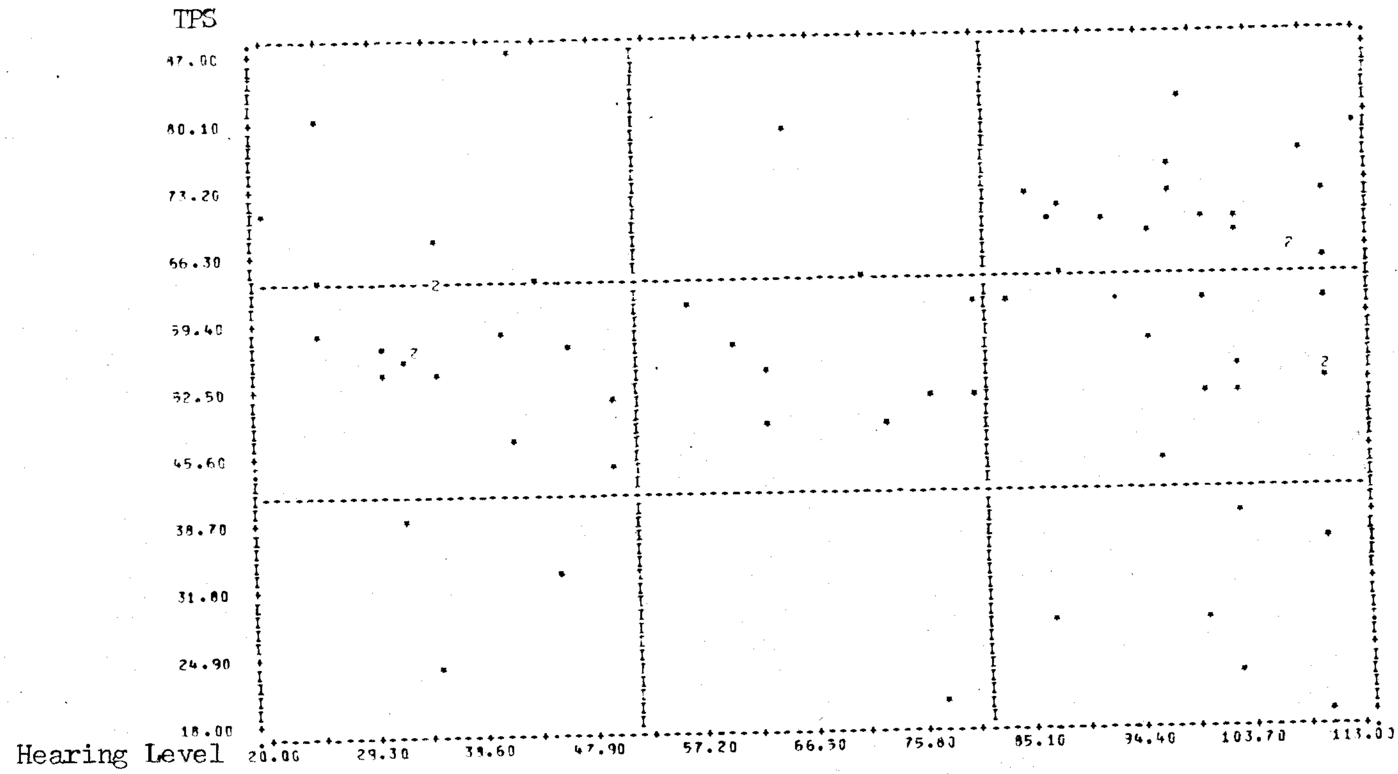
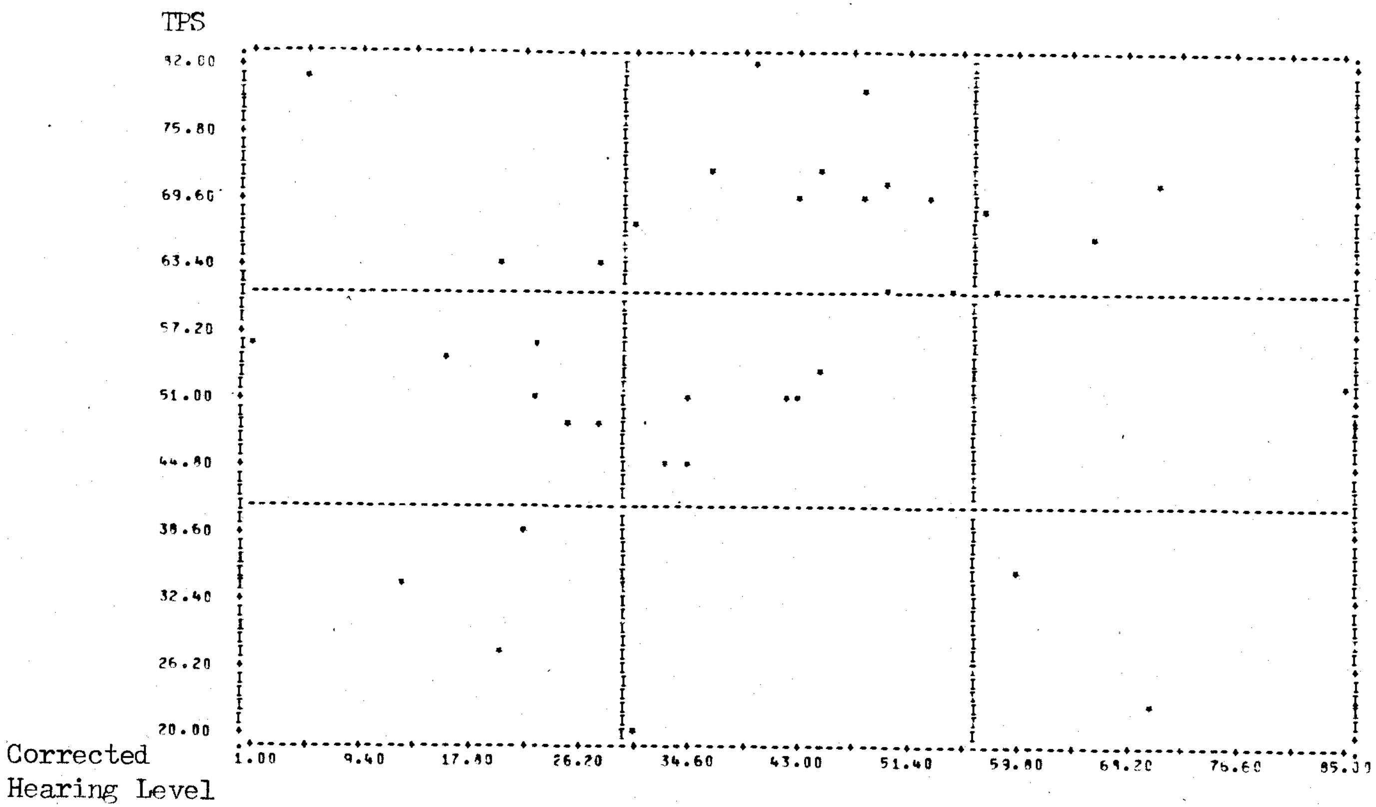


Figure 3. Scattergram of TPS to hearing level.



$r = .12$
$r^2 = .014$

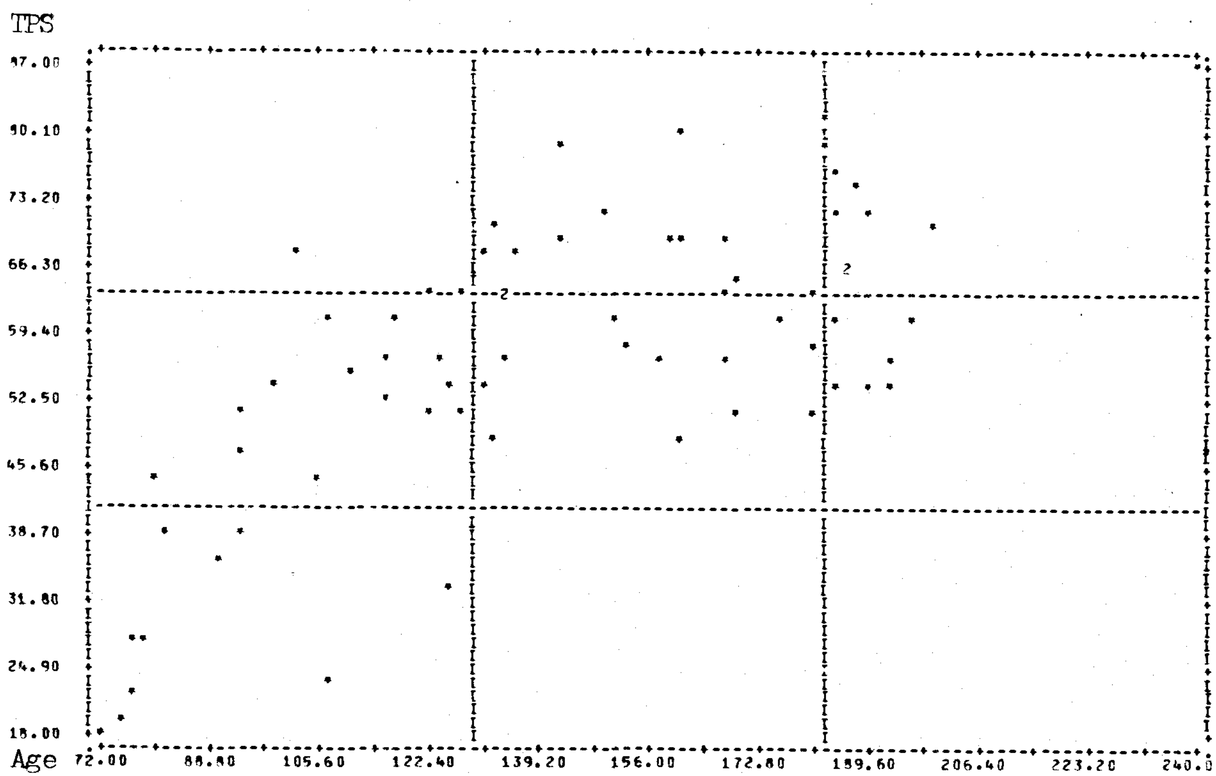
Figure 4. Scattergram and correlation coefficients of TPS and corrected hearing level.

Age

A Pearson Product-Moment coefficient of correlation was calculated to determine the relationship between the age of the 70 subjects and their TPS on the motor proficiency test. Figure 5 includes the correlation coefficient (r), the coefficient of determination (r^2), and a scattergram of the TPS with the ages of the subjects. An r of .69 was computed which is significant at the .001 level. As the subjects increased in age they also increased their total point score. Approximately 48 percent of the variance of TPS was a result of the common factors in age and TPS. Raw scores on an instrument measuring motor proficiency could be anticipated to increase as a function of age or maturation. The shape of the linear relationship shown in the scattergram suggests that this group of hearing impaired students continued to improve in TPS as they increased in age.

Etiology

Because age was significantly related to TPS it was necessary to examine the etiology grouping with respect to age prior to studying the difference between groups in Total Point Score. Table XI shows the results of the *t*-test for difference between the mean ages of the etiology groups. A t value of 1.65 was not significant at the .05 level. The ages of the hereditary and non-hereditary groups were not statistically different and total



$r = .69$*
$r^2 = .48$

*p = .001

Figure 5. Scattergram and correlation coefficients of TPS and age.

point scores were not different for the two groups as a result of an age difference.

TABLE XI

AGE DIFFERENCE BETWEEN ETIOLOGY GROUPS

	n	$\overline{X}$	SD	SEm	t
Hereditary	10	133.90	35.19	11.13	1.65
Non-Hereditary	30	146.60	40.48	7.39	

The hypothesis that there is no difference between hearing impaired grouped in hereditary or non-hereditary etiology groups and motor proficiency (TPS) was tested with a t-test for difference between means. The results of the test, as indicated in Table XII, yielded a t value of .39 which was not significant at the .05 level of confidence. The statistical analysis indicated that the 40 hearing impaired students grouped by hereditary vs. non-hereditary etiology were not significantly different in their TPS on the motor proficiency test.

TABLE XII

COMPARISON OF TPS FOR HEREDITARY AND NON-HEREDITARY ETIOLOGY GROUPS

	n	$\bar{X}$	SD	SEm	t
Hereditary	10	58.40	16.49	5.21	.39
Non-Hereditary	30	56.23	14.55	2.66	

Sex

Table XIII reveals the results of the *t*-test to test for difference in the mean TPS of male and female hearing impaired. The calculated t value of .63 is not significant at the .05 level of confidence indicating that the male and female hearing impaired did not function significantly differently on the motor proficiency exam.

TABLE XIII

COMPARISON OF TPS FOR MALE AND FEMALE GROUPS

	n	$\bar{X}$	SD	SEm	t
Male	36	58.81	15.64	2.61	.63
Female	34	56.53	14.73	2.53	

The potential that one sex outperformed the other but a difference in age negated the difference was studied by calculating a t-test for the difference in the mean age of males and females. A study of Table XIV shows the t-value of .33 which was not significant at the .05 level of probability. The hearing impaired grouped by sex were not statistically different in age. Performance on this motor test does not appear to be affected by the sex of the hearing impaired.

TABLE XIV

COMPARISON OF AGE FOR MALE AND FEMALE GROUPS

	n	$\bar{X}$	SD	SEm	t
Male	36	143.83	42.34	7.06	.33
Female	34	140.68	35.93	6.16	

Educational Placement

The hearing impaired selected for this study were placed into one of six groups according to educational placement. Only four categories within educational placement were used in the final analysis. The results of the one-way analysis of variance (ANOVA) for the total point scores of the educational placement groups are presented in Table XV. This table reveals an F ratio of 4.42 for groups indicating that there was a significant difference in TPS among educational placement groups.

The Student-Newman-Keuls procedure was used as the subsequent test of significance to determine which placement groups differed

TABLE XV

SUMMARY TABLE OF ANOVA FOR TPS BY EDUCATIONAL PLACEMENT

source	df	SS	MS	F
Between Groups	4	3377.20	844.30	4.42*
Within Groups	65	12431.50	191.25	
Total	69	15808.70		

*p = .003

significantly. Table XVI shows the results of this analysis with significant differences starred. Group 2, the OSSD day students

TABLE XVI

STUDENT-NEWMAN-KEUL'S PROCEDURE APPLIED TO THE MEANS OF TPS OF EDUCATIONAL PLACEMENT GROUPS

Group	public schools n=35	OSSD day n=11	OSSD residential n=17	transition in n=5
Means	59.60	44.00	65.12	51.67
	1	2	3	4
1	---	15.60*	5.52	7.93
2	---	---	21.12*	7.69
3	---	---	---	13.45
4	---	---	---	---

*significant at the .05 level

scored the lowest in total point scores with the transition group and public school group scoring the next highest TPS in that order. The OSSD residential group had the highest TPS mean. The differences between the OSSD day students and the public school students were significant as were the differences between the OSSD day students and the OSSD residential students.

Because of the strong relationship between TPS and age, the possibility of age differences of the subgroups affecting TPS was studied. A t-test was computed to determine if a significant difference existed between the ages of the OSSD day students and the OSSD residential students and between the OSSD day students and the public school students. If a significant difference was present, the differences in total point scores could be at least partially explained by age. Table XVII reveals that the two OSSD groups were not significantly different at the .05 level with respect to age. The t value of 1.88 is not equal to or higher than the tabled value of 2.18. The difference between OSSD day students and the public school students with respect to age is reported in Table XVIII which summarizes the t value computed. A study of Table XVIII shows that the computed t value of 1.13 was not equal to or greater than the table t value of 2.02 and, therefore, the difference in the ages of the two groups was not significant.

While the OSSD day students were not significantly different in age from the residential group or the public school group,

TABLE XVII

COMPARISON OF OSSD DAY TO RESIDENTIAL SUBJECTS BY AGE

	n	$\overline{X}$	SD	SEm	t
Day	11	125.73	54.09	16.31	1.88
Residential	17	157.18	25.75	6.25	

t(.05) = 2.18

TABLE XVIII

COMPARISON OF OSSD DAY STUDENTS TO PUBLIC SCHOOL STUDENTS WITH RESPECT TO AGE

	n	$\overline{X}$	SD	SEm	t
OSSD day	11	125.73	54.09	16.31	1.13
Public School	35	142.17	39.27	6.64	

t(.05)44df = 2.02

a study of the difference in mean ages between those groups showed an important trend. Table XIX reveals the differences between means of the educational groups. A study of Table XIX reveals that the age difference between OSSD day students and OSSD residential students was 32.05 months. While this was not found significant (Table XVII) the investigator felt it was possible that if the OSSD day group had a larger n, the relationship of age and educational placement would be clearer.

TABLE XIX

DIFFERENCE BETWEEN MEANS OF EDUCATIONAL GROUPS WITH RESPECT TO AGE

Group	Day Student	Residential	Public School
Means	125.73	157.18	142.17
	1	2	3
1	---	32.05	16.44
2	---	---	15.61
3	---	---	---

Regression Equation

To analyze the relationship between the total point scores and the variables associated with hearing impairment, the multiple regression statistical technique was used. Multiple regression analysis controls for confounding factors of variables in order to evaluate the contribution of a specific variable or set of variables.

Many of the variables in this study were at the nominal level and could not be assumed to have order. Regression analysis assumes data are at least at an interval level. The nominal variables were transformed to "dummy variables" by treating each category as a separate variable and assigning a score to that created variable. The variable was then considered on an interval level and, therefore, could be inserted into the equation.

All variables, i.e. age, sex, etiology, hearing level, corrected hearing level, onset age, five education placement categories, and total point score, were used in the first attempt to set up a regression equation. This attempt created an equation based on only 21 students because the scores of the students with at least one missing variable were deleted. The equation with only 21 students and so many variables was inappropriate, bulky, and not statistically significant.

A second simplified equation was run attempting to utilize the most subjects with the variables most likely to show relationship. Hearing level was deleted because of its extremely low correlation to TPS. Corrected hearing level, onset age, etiology, educational placement in the category transition into public school or half-day students were all deleted because of the number of missing variables and/or the low correlation potential from the initial analysis. This resulting equation provided the opportunity to statistically examine the relationship of the selected variables under the best situation these data allow.

The mean TPS of this group for the final regression analysis was 54.61 with a SD of 15.23 as compared to the original 70 students with a TPS mean of 57.70 and a SD of 15.14. This difference was not significant at the .05 level (t=1.04, 112df). The presentation of the simple correlation coefficients revealed in Table XX pertains only to the strength of the relationship because of the nature of the variables within the equation. The reported relationship of .52 between OSSD day placement and public school placement has little meaning. OSSD day placement exhibited a slight relationship to age (r=.52) and a moderate relationship (r=.63) to TPS. A strong relationship between age and TPS is apparent from the coefficient of .76 for this group of students.

TABLE XX

SIMPLE CORRELATION COEFFICIENTS FOR SELECTED VARIABLES

group	age	sex	public school	OSSD day
sex	-.16			
public school	-.16	.08		
OSSD day	-.52	.05	.52	
TPS	.76	-.12	-.11	-.63

Table XXI shows the summary multiple regression statistics from the analysis. The regression equation using these data was:
TPS=17.47 + .28(age) + (-.36)sex + (3.77) p.s. + (-10.62)OSSD day
The regression coefficients (B) are difficult to interpret by themselves because of the nature of the "dummy variables" used to enter the nominal level data into the equation. The importance of the variable can be determined by the F ratio and the significance level for the computed F. Age was significant at the .0001 level in this equation with all other variables accounted for.

With age adjusted for, the educational placement of the students continued to have a significant affect on TPS as indicated by an F ratio of 12.68 which was significant at the .001 level.

TABLE XXI

MULTIPLE REGRESSION SUMMARY TABLE

variable	B	F	P	r	R
age	.23	25.38	.0001	.76	.76
sex	-.36	.65		-.12	.76
public school	3.77	3.87		-.11	.76
OSSD day	-10.62	12.68	.001	-.63	.82
(constant)	17.47				

The development of the multiple regression coefficient (R) further reveals that age alone was strongly related to TPS(.76) and that the addition of the sex variable created almost no change in the R. When educational placement was added the R was raised to .82. The coefficient of determination for the multiple R indicates that 57 percent (R^2=.57) of the variance of TPS was a factor of the common variance of age and TPS. Sixty-eight percent (R^2=.68) of the variance of TPS was a factor of the commonality of the variance of age, educational placement, and TPS. The variable of educational placement contributed to the equation and can be considered a factor to TPS. The regression equation using these variables was statistically significant at the .0001 level as indicated by an F ratio of 20.42 with 4 and 39 degrees of freedom.

Summary of Findings and Discussion

Subjects were described according to hearing level, age, number of subjects in each category, and total point score (TPS). The selected group was normally distributed according to hearing level, age, and TPS. The statistically appropriate number of subjects in each variable category was not assured by the selection process and onset age, transition out of public school, and half-day public school/half-day OSSD as categories did not have sufficient number of subjects to warrant analysis.

The null hypothesis that there is no relationship between the level of hearing impairment and motor proficiency was retained on the basis of an r of .003 using the Pearson Product-Moment correlation technique. The amount of hearing loss associated with a hearing impairment appeared to not affect the amount of points the hearing impaired student accumulated on a motor proficiency exam. This finding is in agreement with Carlson (1972) who found no significant difference in motor ability among groups divided for hearing loss.

Using the Pearson Product-Moment correlation coefficient of .12 the null hypothesis that there is no relationship between the corrected level of hearing and motor proficiency was retained.

The amount of gain received from a hearing aid does not affect the amount of total points the student accumulated on the motor proficiency test.

An r of .69 shows a moderate and significant (p .05) relationship between age and total point score. The null hypothesis that there is no relationship between the age of the hearing impaired and motor proficiency was rejected. The coefficient of determination (r^2=.48) indicated that 48 percent of the variance of total point scores was attributed to the variance in age. As the age of the hearing impaired students increased, their total point scores increased. This expected increase with age or maturation added to the validity of the use of the Bruininks-Oseretsky Test of Motor Proficiency with the hearing impaired and suggested that the subjects of this study continued to increase in TPS as age increased. Carlson (1972) and Boyd (1967) reported that motor development for the hearing impaired subjects in their studies did not appear to increase after age seven. While this study did not look specifically at this question, evidence was available to suggest that the hearing impaired subjects in this study continued to increase in total points scored as age increased. Whether this can equate with an increase in motor development as related to the non-hearing impaired warrants further study.

The null hypothesis that there is no difference between hereditary and non-hereditary deafness with respect to motor proficiency scores was retained on the basis of a t value of .39 between the two groups. The literature supported a significant relationship between some etiologies, primarily meningitis, and some motor areas, primarily balance (Myklebust, 1946; Boyd, 1967; Lindsey & O'Neal, 1976). The etiology grouping of hereditary and non-hereditary in this study combined all the exogenous factors including meningitis and other vestibular related etiologies. This combining of etiologies possibly equaled out the presumed affect of those etiologies. The nature of the test also precluded a detailed study of any particular motor area such as balance when using total point score. This motor test is a general motor examination and combines many motor components into one total point score. While some students in these groups may have scored lower than others on the balance portion of the test or any other area, their total point scores were not significantly lowered from the other hearing impaired students in the study. Care must be taken when inferring from these data because of the small number of students in the hereditary group(10).

The t-test for difference between TPS means of male and female hearing impaired subjects yeilded a t value of .63. The null hypothesis that there is no difference between male and female hearing impaired with respect to motor proficiency was retained. This finding supported Lindsey & O'Neal (1976) and Carlson (1972) who reported sex to not be a factor in the motor performance of the hearing impaired. Bruininks (1978, p.147) reported in the test manual that the males and females in his analysis did not perform significantly differently on the Bruininks-Oseretsky Test of Motor Proficiency (short form). A hearing impairment does not appear to change this finding.

An ANOVA for TPS was computed with four educational placement groups: OSSD day students, OSSD residential students, public school students, and students in transition into public school. The statistical analysis and subsequent test indicated a significant difference between OSSD day students and public school students and a significant difference between OSSD day students and OSSD residential students. On the basis of these findings the null hypothesis that there is no difference among the motor proficiency scores of the hearing impaired grouped by educational placement was rejected. The investigator first studied the possibility that this difference could be attributed to a difference in age between the OSSD day students and the other two groups. A _t_-test was run between the age means of the OSSD day students and the public school students and between OSSD day students and OSSD residential students. This analysis did not show any significant differences in the mean ages of these groups. While the differences between the groups with respect to age were not statistically significant, the difference of 32.05 months between OSSD day students and OSSD residential students was considered substantial by the investigator. With a larger number in each of the OSSD placement groups, this relationship may have become clearer. Age may be a factor in these educational placement groups.

The regression analysis considers the compounding factors of the variables placed into the equation. The first regression equation, although statistically insignificant, did assist in the process of trimming the regression analysis to a significant equation. The final regression equation used the categories of age, sex, public school placement, and OSSD day placement. OSSD residential placement was used as the reference category. The significance of the regression coefficient with respect to age indicated that the age of the subject affected the total point score on the motor test. Which educational placement group the subject was in also affected the total point score as shown by the significance of the regression coefficient for educational placement. The importance of the regression equation was evident because of the statistical ability to study educational placement while accounting for age. If the educational placement groups total point scores were different because of age then the group F value would not have been significant. Age was the single most significant factor in total point score with educational placement the next and only other variable to have an affect on total point score. There were no reported studies in the literature which researched the affects on motor proficiency of educational placement of the hearing impaired. The findings of this study suggest that this variable shoud be considered when studying motor proficiency of the hearing impaired.

Conclusion

The investigator tested the following null hypothesis: There is no relationship between motor proficiency, as measured by the Bruininks-Oseretsky Test of Motor Proficiency, and hearing impairment. Upon the basis of the findings of this study, the null hypothesis was retained. Age exhibited an expected relationship to TPS. Within the limits of this investigation, only one variable associated with hearing impaired students (educational placement) affected the total point score the subjects made on the motor proficiency test.

CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

The literature concerning the motor characteristics or motor proficiency of the hearing impaired and deaf is limited. Studies focused primarily on a balance performance difference between hearing impaired and non-hearing impaired subjects, the rate of motor development of the hearing impaired or deaf as compared to hearing, and motor ability or motor proficiency of the hearing impaired or deaf. Those variables associated with a hearing impairment that are related to performance in the motor area have not been identified by research with the exception of a relationship between etiology associated with vestibular involvement and motor performance, primarily balance. When the essential variables that relate a hearing impairment to motor performance are known, research and assessment of the motor characteristics of the hearing impaired and comparisons of the hearing impaired to non-hearing impaired can be appropriately designed.

The purpose of this study was to discern the relationship of variables associated with hearing impairment to motor proficiency. Motor proficiency was measured by the total point score of the Bruininks-Oseretsky Test of Motor Proficiency (short form). The study was conducted with 70 hearing impaired students from within the Salem Region of Oregon who attended public school ($n=42$) or the Oregon State School for the Deaf ($n=28$). Subjects were classified according to seven variables: age, sex, level of hearing impairment, corrected level of impairment, etiology, and educational placement. The 14 items which comprised the eight subtests of the Bruininks-Oseretsky Test of Motor Proficiency (short form) were given to the students in the manner suggested in the test manual using total communication when necessary.

A Pearson Product-Moment correlation coefficient was established to describe the strength of the relationship between the total point score and age, hearing level, and corrected level. The significant differences between the total point scores of the hearing impaired grouped by sex and etiology were identified using the t-test of differences between means. To determine the significance of the difference between the total point scores and each level of educational placement, the analysis of variance statistical technique was computed with the Student-Newman-Keul's procedure as the subsequent test of significance. Multiple regression analysis was then used to determine the strength of the relationship of the significant variables to motor proficiency while adjusting for the affects of the other variables in the equation.

No significant relationship was found between motor proficiency and level of hearing loss or corrected hearing level. Age was found to be significantly related to the total point scores on the motor proficiency test. There were no differences in the mean total point scores between the hereditary and non-hereditary etiology groups or between the males and females suggesting that these variables did not affect total point score on this test. The analysis of variance and subsequent test indicated a significant difference in total point scores between the OSSD day group and both the OSSD residential group and the public school group in favor of the latter two groups. A significant regression equation was computed with the variables age, sex, and educational placement which identified age and educational placement as significant factors. With regression analysis equating for any potential age difference in the educational groups, significance in educational placement was found.

Conclusion

On the basis of the findings of this study and within the limits of the investigation, it was concluded that there was no relationship between a hearing impairment and motor proficiency. Table XXII shows those variables identified for research in this study and indicates which were determined to be a factor in motor proficiency scores. A study of Table XXII reveals that of the seven variables chosen, one could not be studied because of insufficient n and only two were found to be a significant factor. Table XXIII combines the findings of the past research reported in Chapter II and the present study to reveal those variables associated with a hearing impairment and indicates those that are a factor or are related to motor proficiency or motor performance.

TABLE XXII

AFFECT OF VARIABLES ON MOTOR PROFICIENCY SCORES

age	yes[a]	
hearing loss level		no[b]
corrected level		no
sex		no
age of onset	--	--
etiology		no
educational placement	yes	

[a]has affect or relationship
[b]no affect or relationship

An attempt was made in this study to identify those variables associated with a hearing impairment that may have an affect on motor proficiency. The importance of knowing what characteristics affect or do not affect motor performance cannot be overlooked for appropriate research, assessment, and program planning with the hearing impaired. The intensity of the hearing loss, the corrected level of hearing, sex, and etiology were not identified in this study to be factors relating to motor proficiency scores of the hearing impaired. Age was found to be a significant factor in total point scores, as expected, because of the nature of

TABLE XXIII

VARIABLES ASSOCIATED WITH HEARING IMPAIRMENT AND MOTOR PROFICIENCY

Investigator	Variables						
	age	hearing level	corrected level	sex	age of onset	etiology	educational placement
Long (1932)				yes			
Myklebust (1946)				yes		yes	
Ewing (1957)		yes					
Boyd (1967)	yes[a]					yes	
Carlson (1972)	yes	no[b]		no			
Lindsey & O'Neal (1976)				no			
Schmidt (1981)	yes[c]	no	no	no		no	yes

[a]factor affecting or relating to motor performance
[b]not a factor in motor performance
[c]this relationship was to be expected because of the nature of the test

the criterion instrument used in this study. An apparent affect of educational placement on total point score found in this study is a relatively new finding and becomes a possible intervening variable when working with the motor skills of the hearing impaired. Research in which educational placement is not taken into account or in which students are selected from only one placement option may be inconclusive.

Recommendations for Future Studies

The following recommendations for future studies are made after conducting and analyzing the results of the present study:

1. A study similar to the present be conducted utilizing a stratified random sampling technique to assure enough subjects to statistically examine each variable in the research design.
2. Conduct a study similar to the present study to further define educational placement options of the hearing impaired and their affect on motor performance.
3. Design a study to further define motor proficiency and investigate specific motor areas and how those specific areas may be affected by a hearing impairment.
4. Consider physical education background as a potential variable in a study similar to the present study.
5. Conduct research to study whether educational placement affects can be changed with treatment.

6. Compare hearing impaired subjects with non-hearing impaired using subjects matched for educational placement, age, body type, sex, and other potentially interacting variables.

7. Conduct a study to establish norms for the Bruininks-Oseretsky Test of Motor Proficiency for hearing impaired or determine that the norms established are appropriate for use with the hearing impaired.

8. Design a study to compare the developmental progress of the hearing impaired with the non-hearing impaired using the Bruininks-Oseretsky Test of Motor Proficiency or a similar instrument.

BIBLIOGRAPHY

Barry, A. J., & Cureton, T. F. Factorial analysis of physique and performance in prepubescent boys. Research Quarterly, 1961, 32 (3), 283-300.

Berges, S. A. The deaf student in physical education. Journal of Health, Physical Education and Recreation, 1969, 40, 69-70.

Boyd, J. Comparison of motor behavior in deaf and hearing boys. American Annals of the Deaf, 1967, 112, 598-605.

Bruininks, R. H. Bruininks-Oseretsky test of motor proficiency - examiner's manual. Circle Pines, Minnesota: American Guidance Service, 1978.

Carlson, B. R. Assessment of motor ability of selected deaf children in Kansas. Perceptual and Motor Skills, 1972, 34, 303-305.

Cratty, B. J. Movement behavior and motor learning. Philadelphia: Lea & Febegir, 1967.

Doll, E. A. (Ed.) The Oseretsky test of motor proficiency. Translation from the Portuguese Adaptation. Circle Pines, Minnesota: American Guidance Service, 1946.

Ewing, A. W. G. (Ed.) Educational guidance and the deaf child. London: Manchester Union Press, 1957.

Fleishman, E. A. The structure and measurement of physical education. Englewood Cliffs, N.J.: Prentice - Hall, Inc. 1964.

Geddes, D. Motor development profiles of preschool deaf and hard-of-hearing children. Perceptual and Motor Skills, 1978, 46, 291-294.

Guilford, J. P. A system of psychomotor abilities. American Journal of Psychology, 1958, 71, 164-174.

Harrow, A. J. Taxonomy of the psychomotor domain: a guide for developing behavioral objectives. New York: David McKay, 1972.

Henry, R. M., Lotter, W. S. & Smith, L. E. Factorial structure of individual differences in limb speed, reaction, and strength. Research Quarterly, 1962, 33 (1), 70-84.

Katz, J. Handbook of clinical audiology (2nd ed.). Baltimore, Maryland: The Williams & Wilkins Company, 1978.

Lindsey, D., & O'Neal. Static and dynamic balance skills of eight-year-old deaf and hearing children. American Annals of the Deaf, 1976, 121, 49-55.

Logan, M. J. A comparison of static and dynamic equilibrium among the hearing and hearing-impaired at the elementary and college levels. Unpublished master's thesis, University of Maryland, College Park, 1969. (Abstract)

Long, J. A. Motor abilities of deaf children. New York, New York: Bureau of Publication, Teacher's College, Columbia University, 1932.

Lubin, E. Motor creativity of preschool deaf children. Unpublished doctoral dissertation, The Texas Woman's University, Denton, Texas, 1978.

McCloy, C. H. An analytical study of the stunt type test as a measure of motor educability. Research Quarterly, 1937, 8, 46-55.

Minter, M. G. A comparison of reaction time and movement time in deaf and hearing freshman male college students. Master's thesis. College Park, Maryland: University of Maryland, 1969 (Abstract)

Morsh, J. Motor performance of the deaf. Comparative Psychological Monograph, 1936, 66, 1-51.

Myklebust, H. R. Significance of etiology in motor performance of deaf children with special reference to meningitis. American Journal of Psychology, 1946, 54, 249-258.

______________. Auditory disorders in children. New York, New York: Grune & Stratton, 1954.

______________. The psychology of deafness. New York, New York: Grune & Stratton, 1964.

Neter, J., Wasserman, W. & Whitmore, G. A. Fundamental statistics for business and economics (4th ed.). Boston, Massachusettes: Allyn and Vacon, 1973.

Northern, J. L., & Downs. Hearing in children. Baltimore, Maryland: The Williams & Wilkins Company, 1978.

Oregon Task Force on Total Communication, Oregon Board of Education, 1972.

Oseretsky. Cited in Bruininks, R. H. Bruininks-Oseretsky test of motor proficiency - examiner's manual. Circle Pines, Minnesota: American Guidance Service, 1978.

Pennella, L. Motor ability and the deaf: research implications. American Annals of the Deaf, 1979, 366-372.

Rarick, G. L. Motor development during infancy and childhood. Madison, Wisconsin: College Printing & Typing Company, 1961.

Rarick, G. L. & Dobbins. Basic components in the motor performance of educable mentally retarded children: Implications for curriculum development (Grant no. OEG-0-70-2568-610). Washington, D. C.: U. S. Office of Education, 1972.

Vance, P. C. Motor characteristics of deaf children (Doctoral dissertation, Colorado State College, 1968). Dissertation Abstracts International, 1969, 1146-A. (Order no. 68-14, 746)

Wisher, P. Dance and the deaf. Journal of Health, Physical Education, and Recreation, 1969, 40, 81-84.

APPENDICES

APPENDIX A

PARENT PERMISSION FORM

Dear Parents:

As a graduate student at Oregon State University, I am working on a PhD degree in education. Part of my duties as the physical education director with the Salem Regional Services for the Deaf involve evaluating the motor functioning of the hearing impaired students in the public schools within the Salem Region. This evaluation process included giving the Bruininks-Oseretsky Test of Motor Proficiency (short form), which is a standardized test described on the consent form following this letter. Many of the items on this test are similar to those used in physical education classes and have been given to thousands of school age children throughout the United States.

The project I am undertaking is the study of the relationship between those variables associated with hearing impairment (level of impairment, corrected hearing level, age of onset, educational placement, etiology) and motor proficiency. By knowing the affects of hearing impairment on motor proficiency, we can better plan sound, progressive physical education programs for the hearing impaired within our region.

I would like to ask permission to use the scores from your child's test as part of the data for this study. The name of your child will not be used when working with the data and confidentiality will be strictly enforced. You may, at any time, withdraw your permission to use your child's scores.

I would be happy to answer any questions regarding the study that you may have. A summary of the results will be available at your request.

Thank you for your time.

Sincerely,

Sharon Schmidt
Salem Regional Services for the Deaf
999 Locust Street
Salem, Oregon 97303

(503) 378-4250
1-800-452-7813

CONSENT FORM

Student's Name ______________________________

DESCRIPTION OF THE RESEARCH

The proposed study deals with measuring various motor proficiency parameters in hearing impaired youth, ages six through seventeen years (school-age). Motor proficiency will be assessed by the Bruininks-Oseretsky Test of Motor Proficiency (short form). This screening devise is nationally standardized with normative data for ages four and one-half through fourteen and one-half years. Individual subtests are: running speed and agility, balance, bilateral coordination, visual-motor control, upper-limb speed and dexterity, strength, upper-limb coordination, and response speed. This test is used in public schools nationwide as a screening of present motor performance. The test presents no risks to the child and only one item, when the student is asked to run approximately 30 yards, may present some discomfort. The entire test takes approximately 25 minutes. The test will be conducted on an individual basis by a trained physical educator who will sign and demonstrate directions, if needed, for the hearing impaired student. All data will be grouped data and individuals will remain anonymous. The study is designed to provide descriptive and correlational data relating variables associated with hearing impairment to motor proficiency so that appropriate physical education programming may be designed.

This is to certify that I agree to allow my child to participate in the above study by Sharon Schmidt. I understand the purpose of the research and the tests that are to be given. I further understand that if I have any questions they will be answered by the researcher in person or by mail:

Sharon Schmidt
Salem Regional Services for the Deaf
999 Locust Street
Salem, Oregon 97303
378-4250

I hereby give my consent for ______________________ to participate in the study. I reserve the right to withdraw my consent and discontinue participation at any time.

____
(Parent/Guardian's Signature)

____
(Parent/Guardian's Name Printed)

____
Date

APPENDIX B

HUMAN SUBJECTS COMMITTEE PERMISSION

OREGON STATE UNIVERSITY

Committee for Protection of Human Subjects

Summary of Review

TITLE: The Relationship Between Hearing Impairment and Motor Proficiency in Selected School Age Children

PROGRAM DIRECTOR: John Dunn (Sharon Schmidt)

RECOMMENDATION:

X Approval

_____ Provisional Approval

_____ Disapproval

_____ No Action

REMARKS:

Date: 4/15/91

Signature: Rod. V. Frakes

Rod. V. Frakes
Associate Dean of Research
Phone: 754-3439

cc: Committee Chairman

mep

APPENDIX C

PARENT AND SCHOOL INFORMATION FORMS

SALEM REGIONAL PROGRAM FOR THE DEAF AND HEARING-IMPAIRED

PARENT INFORMATION FORM

Student's Name:
Birthdate:

FAMILY HISTORY

Parent/Legal Guardian ______________________________

Address: ______________________________ Phone ____________

Occupation: Father ____________ H.I. ____ Mother ________ H.I. ___

SIBLINGS

Name	Age	Handicap	Etiology or Cause

Other agencies involved with family: ______________________________

____

Check the following ways that you communicate with your child in the home:

	Always (>90%)	Ususally (51-90%)	Sometimes (10-50%)	Never (<10%)
Speech				
Sign Language				
Fingerspelling				
Gestures				
Writing				

If the child signs, who else living in the home signs? __________

____

EDUCATIONAL HISTORY

(describe program and approximate dates)

Parent training and home programs: Age: ______________________

____

Preschool: ______________________________________

____

	Name of School	Residential	H. I. Classroom	Part-time Classroom	Full-time Classroom	Speech Therapy	Oral Program	Speech and Sign	Resource Room	Other
K										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
Other										

Grades Repeated: ____________________________________

The average hearing person outside of school would classify your child's speech as: (check one)

_______ Very intelligible (similar to the speech of a hearing person of the same age)

_______ Intelligible (somewhat difficult to understand)

_______ Barely Intelligible (can only understand after repetition and use of other cues)

_______ Not intelligible

_______ Child would not ordinarily attempt to use speech

OTOLOGIC AND AUDIOLOGIC HISTORY

1. Briefly describe the nature and cause of the hearing problem:
____
____

2. Age at onset of hearing loss: _____birth _____years old _____unknown

3. Has the student ever worn a hearing aid: _____Yes _____No

4. If a hearing aid is not in use now, explain why: ____________
____

5. At what age did the child first wear a hearing aid: __________ Indicate general success to date.______________________________
____

List the hearing aids the student has worn:

Dates	Manufacturer and Model	Type (Ear level or body)	Comments

6. Does the student have problems with tolerance to loud sounds? _____Yes _____No

7. Does the student have allergies to earmolds? _____Yes _____No

MEDICAL AND DEVELOPMENTAL HISTORY

Please check any physical or health problems of the student

___Visual Problem ___Glasses ___Orthopedic ___Prosthesis

___Brain Damage ___Perceptual-Motor Disorder

___Cerebral Palsy ___Emotional or Behavioral Problems

___Epilepsy ___Ear Infections

___Heart Disorder ___Allergies

___Mental Retardation ___Other

Has the student ever been hospitalized? ____________________

Explain: ____
____
____

Is the student under professional treatment? ________________

Explain: ____
____
____

In what way do you feel the Evaluation Team can be of service to your child?

____
____
____
____
____
____

SALEM REGIONAL PROGRAM FOR THE DEAF AND HEARING-IMPAIRED

SCHOOL INFORMATION FORM

Name:

D.O.B.:

School:

School District:

County:

________Permission for evaluation on file

CURRENT EDUCATIONAL PROGRAM

Daily/Weekly Schedule

Time	Mon	Tue	Wed	Thur	Fri

Does the child receive any special services during the school day?

Special Services	When
________________________	________________
________________________	________________
________________________	________________

Curriculum Materials Used:

Reading____

Approximate Grade Level:______________________

Math____

Approximate Grade Level:______________________

Language Arts__________________________________

Approximate Grade Level:______________________

Spelling_______________________________________

Approximate Grade Level:______________________

Physical Education______________________________

Approximate Grade Level:______________________

BEHAVIORAL CHECKLIST

Behavioral Difficulty

Yes	No	Sometimes	
____	____	____	Excessive absences
____	____	____	Excessive tardiness
____	____	____	Out of seat needlessly
____	____	____	Short attention span
____	____	____	Hostile toward teacher
____	____	____	Manipulates adults to child's advantage
____	____	____	Reluctant to follow directions
____	____	____	Involved in frequent fights
____	____	____	Has difficulty with peers
____	____	____	Difficulty respecting others rights
____	____	____	Child destroys property
____	____	____	Steals
____	____	____	Lies
____	____	____	Seems upset or resistant to change
____	____	____	Has violent outbursts of temper
____	____	____	Is a passive resister

Emotional Difficulty

Yes	No	Sometimes	
____	____	____	Child cries easily
____	____	____	Seems withdrawn, seldom participates
____	____	____	Excessively shy
____	____	____	Too often daydreams, sits with vacant expression
____	____	____	Excessively loud and boisterous
____	____	____	Easily distracted
____	____	____	Tenseness
____	____	____	Nervous mannerisms (tics, tremors, nail biting)
____	____	____	Overly suspicious or jealous of others
____	____	____	Excessive complaints of physical symptoms, pains
____	____	____	Talks incessantly, without permission or interrupts

Other Difficulties: ____

____

____

Communication

How do you think the average hearing person with whom this student might come in contact outside of school (e.g. bus driver, clerk in a store, etc.) might classify this student's speech?

____ Very intelligible (very similar to the speech of a hearing person of the same age)

____ Intelligible (somewhat difficult to understand)

____ Barely intelligible (can only understand after repetition and use of other cues)

____ Not intelligible

____ Student would not ordinarily attempt to use speech

Teacher/Child Communication Modes: Indicate below all modes of communication used between you and the student.

	Always (>90%)	Ususally (51-90%)	Sometimes (10-50%)	Never (<10%
Speech				
Sign Language				
Fingerspelling				
Gestures				
Writing				

SOCIAL INTERACTIONS

Interacts with:

____ hearing impaired peers

____ hearing peers

____ adults

____ does not interact on a social basis

INTERESTS AND ABILITIES

What does the child do well? ______________________________

____

____

What are this child's interests? ___________________________

____

____

PREVIOUS EVALUATIONS

(Date and Results)

Hearing ______________________________

____

Intellectual ______________________________

____

Academic ______________________________

____

Other ______________________________

____

SPECIAL REQUESTS

In what way do you feel the Evaluation Team can be of service with respect to this child's problem?

____

____

____

____

____

APPENDIX D

SIGNING SKILLS

STATE OF OREGON

INTEROFFICE MEMO

TO Harlan Conkey

DATE 3/19/81

FROM Rosemary Farrior
Eleni Lathourakis

SUBJECT Sharon Schmidt

****

Sharon Schmidt asked us both to evaluate her signing skills while adminstering a series of tests to two deaf students. The tests given are those Ms.Schmidt uses during her evaluation of students for her job. The students we observed are both profoundly deaf; one a 5th grader and 11 years old; the other a 3rd grader and 7 1/2 years old. Both were given a series of tests on March 19, 1981 evaluating gross motor skills and fine motor skills. We feel both students understood Ms. Schmidt's directions in sign language and performed accordingly. During her conversation with the students concerning the evaluation and/or directions, she was able to understand their signs and answer appropriately.

Rosemary Farrior, deaf herself, has taught hearing impaired students for 5 years as well as sign language classes at College level for 4 years. Eleni Lathourakis, hard of hearing herself, has taught deaf students for 3 years and is now a guidance counselor.

If you have any further questions or comments, please contact us.

Sincerely,

Rosemary Farrior

Rosemary Farrior

Eleni Lathourakis

Eleni Lathourakis

3/19/81

APPENDIX E

RAW DATA

RAW DATA FORMAT

Column	
1-3	Identification Number
4-6	Age in months
7	Sex
8	Etiology
9-11	Hearing Level
12-14	Corrected Level
15	Onset Age
16	Educational Status
17-18	Total Point Score

RAW DATA

001176231100003461

002182111030421352

003185120930501361

004161111000001470

005133220880501471

006072221101111318

007077121030701323

008133130730283449

Raw Data (continued)

009115221100852453

010091231100601336

011079131001113329

012077230870201328

013126221030451454

014080220500351358

015134230710203464

016186121070661467

017161130630253349

018130131030573469

019196131000551361

020183120980401382

021142230870431470

022184131081111477

023167231030481470

024150230970453473

025185131100713472

026170131100001466

027193221100001454

028087211070001467

029134110350281164

030188220971111175

031076110780301120

Raw Data (continued)

032131121100001554

03312423095111157

03416723088111164

03515922092053170

03613413046001157

03709413050111152

03808213103111139

03909322041111147

04015112056111162

04109912035000155

04215722033111157

04312721035111164

04418312065111180

04516823030111158

04612723077023152

04712313080035325 2

04819022063016155 5

04912622045013113 4

05011012032111156

05118112025111159

05213613035111316 8

05312213025000116 4

05410723035111152 4

Raw Data (continued)

055142111130482580
056153220401111159
057240130410003187
058119130200001171
059193220330001157
060185120300001154
061118210831111161
062107210800581161
063181120431111164
064093120320221139
065190220850361173
066169221000431552
067105110960331545
068102130950301168
069161230250053181
070116220600231157

APPENDIX F

BRUININKS-OSERETSKY TEST DIRECTIONS

SUBTEST 1*

Running Speed and Agility

The subject runs to the end line, picks up the block, and runs back across the start/finish line. The subject is timed between the first and last crossings of the timing line.

Trials: 2

ADMINISTERING AND RECORDING

Stand beside the timing line and have the subject stand behind the start/finish line. Say: "When I say On your mark, get set, go, run as fast as you can to the block (point to block), pick it up, and bring it back across this line (point to start/finish line). Don't slow down; run fast across this line (point again to start/finish line). On your mark, get set, go!"

Start the watch when the subject crosses the timing line and stop the watch when the subject crosses the timing line with the block. If the subject slows down as she or he approaches the timing line, remind the subject to continue to run fast across the start/finish line.

Start the trial over if the subject:

a. stumbles or falls
b. fails to pick up the block
c. drops the block before crossing the timing line.

On the second trial, encourage the subject to run faster.

Record the time to the nearest 0.2 second in the appropriate space on the Individual Record Form. If the hand of the stopwatch is between two numbers, record the higher number.

* Bruininks-Oseretsky Test of Motor Proficiency Examiner's Manual (Bruininks, 1978).
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SUBTEST 2 / Item 1

Standing on Preferred Leg on Balance Beam

The subject stands on preferred leg on the balance beam, looking at the target, with hands on hips, and with other leg bent so that it is parallel to the floor. The subject must maintain the position for 10 seconds to achieve a maximum score.

Trials: 2 Administer a second trial only if the subject does not achieve a maximum score on the first trial.

ADMINISTERING AND RECORDING

Place the balance beam over the walking line.

Say: "Stand on the beam on your (right/left) leg and raise your other leg like this (demonstrate). Place your hands on your hips and look at the target. Stand like this until I tell you to stop."

If necessary, help subject achieve the correct position. Begin timing as soon as position is achieved and remind subject as needed to keep hands on hips and to look at target. Slight swaying is acceptable. Allow only one warning to keep the raised leg parallel to the floor (or abovea 45° angle).

After 10 seconds, tell the subject to stop. Stop the trial and record the time before 10 seconds if the subject:

a. drops the raised leg so that it touches the floor
b. drops the raised leg below a 45° angle after one warning
c. hooks the raised leg behind the supporting leg
d. shifts the supporting foot out of place.

On the Individual Record Form, record to the nearest second the time that the subject maintains the correct position.

SUBTEST 2 / Item 2

Walking Forward Heel-to-Toe on Balance Beam

The subject walks forward on the balance beam heel-to-toe, with hands on hips. The subject must make six consecutive steps correctly to achieve a maximum score.

Trials: 2 Administer a second trial only if the subject does not achieve a maximum score on the first trial.

ADMINISTERING AND RECORDING

Place the balance beam over the walking line.

Have the subject stand at one end of the beam. Say: "Place your feet on the beam like this (demonstrate). Place your hands on your hips. When you walk down the beam, hit the toe of your back foot with the heel of your front foot (demonstrate). Walk to the end of the beam. Remember, keep your feet on the beam and your hands on your hips as you walk. Ready, begin."

Stand at one side of the beam and count the subject's steps, keeping track of both correct and incorrect steps. A step is incorrect if the subject:

a. does not touch the heel of the front foot to the toe of the back foot
b. moves the back foot forward to touch the heel of the front foot.

Remind the subject as needed to walk heel-to-toe and to keep hands on hips. After six steps have been taken, tell the subject to stop. If the subject places one or both feet completely off the beam before taking six steps, stop the trial and record the number of steps taken on the beam.

On the Individual Record Form, record the number of correct and incorrect steps. Use "1" for correct steps and "0" for incorrect steps. For example, 1-1-0-1-1-0 equals a score of 4.

SUBTEST 3 / Item 1

Tapping Feet Alternately While Making Circles with Fingers

The subject taps feet alternately while making circles with index fingers. The subject is given 90 seconds to complete 10 consecutive foot taps correctly. The score is recorded as a pass or a fail.

Trials: 1

ADMINISTERING AND RECORDING

Place two chairs facing each other; have the subject sit facing you. The subject's arms are held at, or slightly below, shoulder height with elbows bent and index fingers pointing toward the examiner. One index finger is to move clockwise and the other counterclockwise.

Say: "First tap one foot and then the other foot like this (demonstrate). At the same time you tap your feet, hold your arms in front of you and close your hands, pointing your first (index) fingers to me like this (demonstrate). Make circles with just your fingers; try not to move your hands, wrists, or arms (demonstrate). Keep tapping your feet and making circles with your fingers until I tell you to stop. Ready, begin."

(The subject may tap toes with heels resting on floor, tap with the entire foot, or tap heels with toes resting on floor, as long as the tapping rhythm is consistent.)

Begin timing. If necessary, provide additional instruction. Start counting taps as soon as the subject establishes a consistent tapping rhythm. During the trial, correct the subject and start counting over if he or she:

a. does not maintain a consistent tapping rhythm
b. fails to alternate feet
c. fails to make circles simultaneously with both fingers
d. uses wrist and forearms in making circles
e. fails to make complete circles. (Wiggling fingers is incorrect.)

Allow no more than 90 seconds, including time needed for additional instruction, for the subject to complete 10 consecutive foot taps correctly. After 90 seconds, tell the subject to stop.

On the Individual Record Form, record pass or fail.

SUBTEST 3 / Item 2

Jumping Up and Clapping Hands

The subject jumps as high as possible, clapping hands in front of face as many times as possible before landing. The subject must clap five times to achieve a maximum score.

Trials: 2 Administer a second trial only if the subject does not achieve a maximum score on the first trial.

ADMINISTERING AND RECORDING

Stand facing the subject. Say: "When I tell you to begin, jump straight up as high as you can. As you jump, clap your hands in front of your face as many times as you can before you land (demonstrate). Ready, begin."

Count claps as subject jumps. Do not count claps that are made while subject's feet are on the floor or claps that are made below chest level. Mark the trial "0" if the subject loses balance and touches the floor with one or both hands when landing.

On the Individual Record Form, record the number of claps made correctly.

SUBTEST 4

Standing Broad Jump

The subject jumps forward as far as possible, starting from a bent-knee position. The distance of each jump is recorded.

Trials: 3

ADMINISTERING AND RECORDING

Have the subject jump up and down a few times before starting. Then say: "Stand behind this line (point to starting line) with your feet spread about as far apart as your shoulders (demonstrate). Bend your knees, lean forward, and swing your arms at your sides a few times. When I say go, put your arms back and jump forward as far as you can, letting your arms swing forward, and land on both feet (demonstrate). Remember, bend your knees, swing your arms back, and jump as far as you can. When you jump, let your arms swing forward and try to land on both feet. If you lose your balance, try to fall forward. Ready, go."

Between trials repeat instructions as necessary.

Correct the subject and readminister the trial if the subject shuffles over the starting line before jumping or if the subject jumps up instead of forward.

On the Individual Record Form, record the distance jumped on each trial by noting the number that is nearest the point where the back of the subject's heels land. If one foot lands behind the other, measure to the heel that is nearest the starting line. If the subject loses balance and falls backward, measure to the point where the subject's hands (or other part of the body nearest the starting line) touch the floor.

SUBTEST 5 / Item 1

Catching a Tossed Ball with Both Hands

The subject stands on the standing mat and, with both hands, catches a tennis ball tossed underhand from a distance of 10 feet (3 meters). The number of correct catches is recorded.

Trials: 1 practice, 5 recorded

ADMINISTERING AND RECORDING

Say: "Stand on the mat and catch this ball with both hands when I throw it to you." Give the subject one practice trial. Stand behind the strip of masking tape and slowly toss the ball underhand in a slight arc so that it comes down between the subject's shoulders and waist. Then say: "Catch the ball with both hands each time I throw it to you."

Count the number of correct catches made in five trials. A catch is incorrect if the subject:

a. misses the ball or traps it against the body
b. steps off the mat
c. catches the ball with one hand

If the subject misses the ball because it is thrown above the shoulders, below the knees, or outside the subject's reach, readminister that trial. Between trials, repeat instructions as necessary.

On the Individual Record Form, record the number of correct catches.

SUBTEST 5 / Item 2

Throwing a Ball at a Target with Preferred Hand

With the preferred hand, the subject throws a tennis ball overhand at the target from a distance of 5 feet (1.5 meters). The subject receives a point each time the ball is correctly thrown and hits the target.

Trials: 1 practice, 5 recorded

ADMINISTERING AND RECORDING

Say: "Stand behind this line (point to the masking tape on the floor in front of the target). You are to throw the ball overhand at the bull's-eye (point to target; then demonstrate). Throw from behind this line." Give the subject one practice trial. The subject may throw overhand in a modified sidearm motion with both feet stationary, or may take one step forward toward the target while throwing. Then say: "Ready, begin."

Stand behind the subject and count the number of correct throws in five trials. A throw is incorrect if the subject:

a. misses the target (Hitting the black perimeter of the target is acceptable.)
b. throws underhand
c. steps over the line.

Between trials, repeat instructions as necessary. After five trials, tell the subject to stop.

On the Individual Record Form, record a "1" for each correct throw and a "0" for each incorrect throw.

SUBTEST 6

Response Speed

The subject places the preferred hand flat on the wall, next to the response speed stick. The examiner holds the stick vertically against the wall and then drops the stick. The subject uses the thumb of the preferred hand to stop the stick as it drops. The response speed stick number that is at or just above the tape strip when the stick is stopped is the trial score. The point score is derived from the trial scores.

Trials: 2 practice, 7 recorded

ADMINISTERING AND RECORDING

Sit beside the subject, facing the wall; the subject should be seated with his or her preferred arm away from you. Say: "We are going to find out how fast you can stop a falling stick." Place the response speed stick flat against the wall in front of the subject so that the starting line on the stick is even with the top edge of the tape. Then say: "Let me show you what to do. Put your (right/left) hand against the wall next to the red line on the stick." Help the subject place the preferred hand against the wall with the thumb about 1/2 to 1 inch (1.3 to 2.5 cm) away from the stick, spreading the fingers in a comfortable, fan-like position. The thumb should be over, but not on, the stick; no part of the subject's hand should touch the stick before it is dropped.

Say: "Watch the red line on the stick (point to red line). When the red line moves, stop the stick as fast as you can with your thumb (demonstrate by placing the subject's thumb against the stick). Just before I let the stick fall, I will say Get set! Then, when you see the red line move, stop the stick with your thumb as fast as you can.

Give the subject two practice trials. For each trial, say "Get set!" slowly and deliberately and then wait the number of seconds shown on the table below before releasing the stick. Count the seconds silently - one thousand one, one thousand two, etc. Keep the stick perpendicular to the tape strip and make certain that the subject is observing the red line before you release the stick.

Trial	Seconds
Practice 1	1
Practice 2	3
1	2
2	3
3	1
4	3
5	2
6	1
7	1

Administer seven test trials. Repeat instructions and readminister a test trial if the subject:

a. fails to look at the stick when it is dropped

b. touches the stick before or just as it is released.

On the Individual Record Form, record the response speed stick number that is at, or just above, the tape strip when the subject stops the stick. This is the trial score. Record "0" for a trial if the subject does not stop the stick before it hits the floor.

To obtain the point score for Subtest 6, rank the scores for the seven test trials from highest to lowest. The median (middle) score is the point score. For example, if the subject's scores on the seven trials, ordered from highest to lowest, are 8-7-6-5-4-4-3 the subject's point score is 5. Then a 5 would be recorded as the score for Subtest 6.

SUBTEST 7 / Item 1

Drawing a Line Through a Straight Path with Preferred Hand

For this item, the subject uses the preferred hand to draw a pencil line through a path. The number of errors made is recorded.

Trials: 1

ADMINISTERING AND RECORDING

Clip the Student Booklet to the clipboard and have red pencils ready to use. While holding one corner of the clipboard, say: "This is a road (point to path). Take the red pencil and draw a line from here (point to car) to the end of the road, here (point to garage). Stay inside the lines - try not to go off the road. Take as much time as you need. Ready, begin."

Allow as much time as necessary. Keep your hand on the clipboard and do not allow the subject to rotate the test page more than 45° while drawing.

In the Student Booklet, record the number of errors made, up to a maximum of seven. An error is made each time the line goes outside the boundary lines. Count an additional error for each one-half inch (1.27 cm) the line remains outside the boundary lines. Transfer the number of errors recorded in the Student Booklet to the Individual Record Form.

SUBTEST 7 / Items 2, 3

Item 2 Copying a Circle with Preferred Hand

Item 3 Copying Overlapping Pencils with Preferred Hand

For these two items, the subject uses the preferred hand to copy a geometric shape. The accuracy of each drawing is evaluated and scored.

Trials: 1 for each item

ADMINISTERING AND RECORDING

Clip the Student Booklet to the clipboard and have black pencils ready to use. Say: "Look at the (name shape) in this box. With your (right/left) hand make one just like it in the empty box below (point to box). Take as much time as you need. Ready, begin."

Allow as much time as necessary for the subject to complete each drawing. Erasing is permitted. Keep your hand on the clipboard and do not allow the subject to rotate the test page more than 45^{o} while drawing.

Have the subject go on to the next item. Refer to the scoring directions in Appendix A for these two items when the testing session has been completed. In the Student Booklet, record the number of points given for each drawing. Transfer this point score to the Individual Record Form.

SUBTEST 8 / Item 1

Sorting Shape Cards with Preferred Hand

With the preferred hand, the subject sorts a mixed deck of red and blue cards into two piles, separating them by color. The number of cards correctly sorted in 15 seconds is recorded.

Trials: 1 practice, 1 recorded

ADMINISTERING AND RECORDING

Place one red card and one blue card on the testing pad in front of the subject. Shuffle the remaining cards. Say: "When I say go, put all the red cards here (point to red card) and all the blue cards here (point to blue card). Use your (right/left) hand to sort the cards one at a time as fast as you can (demonstrate). Hold the cards in your other hand. Now you try it." As a practice trial, have the subject sort five cards. Then reshuffle the cards, leaving one red card and one blue card on the testing pad as sorting guides. Place the deck on the testing pad. Then say: "Keep sorting the cards with your (right/left) hand until I tell you to stop. Ready, go!"

Begin timing when the subject touches the cards. Count the number of cards the subject sorts correctly. If the subject sorts more than one card at a time, give credit for only one card. If the subject changes hands, readminister the trial. After 15 seconds tell the subject to stop.

On the Individual Record Form, record the number of cards sorted correctly, do not count the guide cards.

SUBTEST 8 / Item 2

Making Dots in Circles with Preferred Hand

The subject makes a pencil dot inside each of a series of circles. The number of circles dotted correctly in 15 seconds is recorded.

Trials: 1 practice, 1 recorded

ADMINISTERING AND RECORDING

Clip the Student Booklet to the clipboard and have red pencils ready to use. Say: "When I say go, take the red pencil in your (right/left) hand and make one dot in each circle as fast as you can." Demonstrate by tapping with the eraser end of the pencil in a left-to-right progression in the practice circles. Then say: "Now you try it here" (point to practice circles). Have the subject make one dot in each of the practice circles. It is not necessary for the subject to make dots from left to right. Then say: "Make one dot in each of these circles (point to circles below line). Put a dot in as many circles as you can as fast as you can. Ready, go!"

Begin timing when the subject touches the pencil to the paper. After 15 seconds, tell the subject to stop.

In the Student Booklet, record the number of circles dotted correctly. Do not count circles without dots or circles with two dots. Transfer the number to the Individual Record Form.

APPENDIX G

STUDENT DATA SHEET

STUDENT DATA SHEET

Subject ______________________________ No. ____________

Age __________ years ____________ months ________ MONTHS

Sex 1. Male 2. Female

Etiology 1. Hereditary 2. Non-Hereditary 3. Unknown

Level of Hearing Impairment ________________ dB PTA

Corrected Level ________________ dB PTA

Age of Onset 1. Before age two 2. After age two 3. Unknown

Educational Status

1. public school full-time
2. public school part time/OSSD part time
3. OSSD day student
4. OSSD residential student
5. transition into public schools
6. transition out of public schools

BRUININKS-OSERETSKY TOTAL POINT SCORE ______________