JADARA

Volume 25 | Number 1 Article 10

October 2019

Effect of Age, Sex, Hearing Loss and Etiology Upon Manual Dexterity Skill of Deaf Children

John M. Zody
Ft. Hays State University

Dean R. Gorman
University of Arkansas

EFFECT OF AGE, SEX, HEARING LOSS AND ETIOLOGY UPON MANUAL DEXTERITY SKILL OF DEAF CHILDREN

JOHN M. ZODY, Ed.D.
Ft. Hays State University
Hays, Kansas

DEAN R. GORMAN, Ph.D.
University of Arkansas
Fayetteville, Arkansas

Abstract

The primary purpose was to determine the effect age, sex, hearing loss, and etiology had on the performance of manipulative tests. A secondary purpose was to investigate the relationship between reaction time and manual dexterity. Fifty subjects with deafness, age eight to fifteen, participated. ANOVA revealed one significant difference between etiological groups. Ten significant differences were identified for age. Post-hoc evaluation identified the performance of the youngest and oldest age groups to be significantly different. Two-sample independent *t*-tests were performed to investigate the between group differences of severe $< = 90$ db vs. profound > 90 db hearing loss and male vs. female. There was no significant difference between severe/profound hearing loss or male/female on the performance of manipulative tests. Pearson Product-Moment correlation was performed to investigate the relationship between manipulative skills and reaction time. A high ($p > 0.05$) correlation was found between manipulative skill and reaction time variables.

Introduction

There is general agreement among researchers that children with deafness, as a group, experience a significantly greater number of gross motor performance deficits than their non-disabled peers. Vance (1968) reported that children with deafness ages five to twelve performed significantly lower than their non-disabled peers on sixty percent of motor tasks under investigation. Similarly, girls with deafness scored significantly lower on twenty percent of the tasks. Weigersma and Van der Velde (1983) confirmed Vance's findings that children with deafness exhibit delays in motor development and suggested that the motor slowness of children with deafness may be a result of longer movement time, possibly due to processes underlying the execution of the movement. Lindsey and O'Neal (1976) found that eight year old deaf children failed a greater number of static and dynamic balance test items than a comparable non-disabled group. Similarly, Boyd (1967) reported significant differences among deaf and non-disabled groups on tests of static equilibrium. However, Boyd also found no significant differences between groups on eye-hand

EFFECT OF AGE, SEX, HEARING LOSS AND ETIOLOGY UPON MANUAL DEXTERITY SKILL OF DEAF CHILDREN

coordination tasks. Other evidence suggests that young children with deafness may be superior to young nondisabled children in measures of drawing and hand positioning but, in later childhood these significant differences disappear (Cratty, Cratty, and Cornell, 1986).

Literature relative to the effect of age, sex, hearing loss level, and etiology upon general motor ability and specifically, manual dexterity skills of children with deafness, is very limited. Mykelbust (1964) and Padden (1959) observed a greater number of balance difficulties within children whose deafness resulted from meningitis. Butterfield (1987) reported static balance differences between a genetic and idiopathic etiology group, but failed to show any significant differences between four of the five etiology groups under investigation. Research by Boyd (1967) failed to demonstrate balance differences between etiology groups of children with deafness. Various researchers have reported no significant differences in balance ability between male and female deaf populations (Carlson, 1972; Lindsey and O'Neal, 1976; Butterfield, 1987). Brunt and Broadhead (1982) and Butterfield (1987) found that static and dynamic balance ability of children with deafness increases with age.

Even though researchers have reported differences in balance abilities between younger and older children with deafness, they have found no differences between male and female groups and have reported contradictory findings in reference to etiology. There is a paucity of research in the literature in regard to the manipulative performances of children with deafness. The present study is unique since it attempts to discern the influence of age, sex, hearing loss level, and etiology on fine motor manipulative performances of children with deafness.

Method

Twenty-nine female and twenty-one male subjects (Mean age = 146.3 months, SD = 21.67) attending a school for the deaf participated. Subjects were void of diagnosed disabilities other than deafness, had at least a 60 decibel hearing loss in the better ear and were considered in excellent health. Subjects received identical manipulative testing by the same investigator. A sign-language interpreter was used to facilitate tester-subject communication throughout the testing period. Subjects were administered a battery of seventeen manipulative and three simple reaction time tests.

Means and standard deviations were calculated for each subject group and a one-way Analysis of Variance was used to assess the influence of etiology (pre-natal, post-natal, heredity, idiopathic) and age (96-119 mos., 120-143 mos., 144-167 mos., 168-189 mos.) on indices of manipulative ability and reaction time. The Least Significant Difference Test was used for post-hoc examination of group differences for hearing loss level (≤ 90 db vs. > 90 db) and sex difference. Pearson Product-Movement Correlations were used to identify relationships between the manipulative tasks and reaction time variables. Statistical significance was established at the .05 level.

Results

Intergroup comparisons revealed a significant difference for etiology on one of the seventeen manipulative variables. Analysis of the age data found ten of the seventeen variables to be significant. ANOVA results are summarized in Tables 1 and 2. Post-hoc comparisons reveal that the oldest age group (168-189 mos.) exhibited significantly better manipulative performance scores than the youngest age group (96-119 mos.).

EFFECT OF AGE, SEX, HEARING LOSS AND ETIOLOGY UPON MANUAL DEXTERITY SKILL OF DEAF CHILDREN

Table 1
Summary of Analysis of Variance Tests on the Influence of Age (96-119, 120-143, 144-167, 168-191) and Etiology (Pre-Natal, Post-Natal, Hereditary, Idiopathic) on Bruininks-Oseretsky Subtest Eight

	AGE		ETIOLOGY	
Test	F-Value	Probability	F-Value	Probability
B1	9.90	.0001*	.97	.4150
B2	5.23	.0034*	.55	.6499
B3	4.46	.0079*	.35	.7910
B4	4.09	.0117*	2.82	.0493*
B5	—	—	.52	.6698
B6	—	—	.25	.8589
B7	4.25	.0098*	1.72	.1763
B8	6.74	.0007*	2.46	.0743

*Significant ($p < .05$)
Age (df = 3,46); Etiology (df = 3,46)
B1 - B8 = Bruininks-Oseretsky Subtest Eight Items One Through Eight

Table 2
Summary of Analysis of Variance Tests on the Influence of Age (96-119, 120-143, 144-167, 168-191) and Etiology (Pre-Natal, Post-Natal, Hereditary, Idiopathic) on PR, PL, PB, PTL, ASM, GBR, GBL, MMP, MMT

	AGE		ETIOLOGY	
Test	F-Value	Probability	F-Value	Probability
PR	4.10	.0116*	.40	.7545
PL	—	—	.70	.5582
PB	—	—	.90	.4481
PTL	—	—	.59	.6238
ASM	3.91	.0144*	.66	.5828
GBR	—	—	.66	.5811
GBL	—	—	.84	.4803
MMP	2.94	.0428*	1.09	.3620
MMT	4.69	.0061*	.50	.6845

*Significant ($p < .05$)
Age (df = 3,46); Etiology (df = 3,46)

PR = Purdue Pegboard (right hand)
PL = Purdue Pegboard (left hand)
PB = Purdue Pegboard (both hands)
PTL = Purdue Pegboard (PR + PL = PB)
ASM = Purdue Pegboard (assembly)
GBR = Grooved Pegboard (right hand)
GBL = Grooved Pegboard (left hand)
MMP = Minnesota Manual (placing)
MMT = Minnesota Manual (turning)

EFFECT OF AGE, SEX, HEARING LOSS AND ETIOLOGY UPON MANUAL DEXTERITY SKILL OF DEAF CHILDREN

Further, the two middle age groups (120-143 mosand 144-167 mos.) performed significantly better than the youngest age group on a number of items. Examination of the etiology data revealed that the post-natal and hereditary groups exhibited significantly faster manipulative skill on variable B4 than the pre-natal group.

No significant differences attributed to hearing loss level (‹ = 90 db vs. › 90 db) were detected when *t*-test data were analyzed. One significant difference was noted between male and female groups. Pearson Product-Moment Correlations found significant relationships between the three reaction time variables and sixteen of the seventeen manipulative tasks. GBL was the only variable not reaching significance.

Discussion

Etiology

A one-way ANOVA was performed to compare means from the etiology groups. The first ANOVA model deleted any observation that had an idiopathic etiology classification. Results indicated that etiology had no effect on the performance of any of the seventeen variables included in the present study. This tends to agree with the findings of Boyd (1967). His study, as the case with the current model, grouped the subjects pre-natal, post-natal and hereditary. Findings indicated there were no significant differences among etiology groups on tests of locomotor coordination. A further finding of Boyd's study indicated speed of motor functioning measured by the Oseretsky Test was not statistically different between etiologies.

By including the idiopathic etiology observations into the model, one variable (B4) was identified as being significant. The Least Significant Difference post-hoc test revealed the pre-natal group to be significantly different when compared to post-natal and hereditary groups. Boyd (1967) noted the pre-natal group usually exhibits the lowest levels of performance and a slower rate of development. This pattern was observed in twelve of the seventeen tests administered in the present study. Other evidence suggests that the balance ability of the genetic group is superior to the balance performance of idiopathic subjects (Butterfield, 1987). The present findings tend to disagree with Mykelbust (1946) and Padden (1959) who observed greater balance problems among subjects with meningitis etiologies. One possible reason for the disparity between findings may be that a majority of research has focused on balance ability and the present study investigated fine-motor manipulation ability between etiology groups.

Age

ANOVA was performed to determine if a significant difference between age groups existed in the performance of any of the seventeen variables. First, the ANOVA model deleted any observations with an idiopathic etiology. By doing this, results could positively identify which etiology groups were significantly different. It is very possible that an unknown classified subject may have had one of the other three etiologies, but evidence was not conclusive enough to positively classify him or her as such. The present classificant of etiologies (pre-natal, post-natal and hereditary) is similar to that used by Boyd (1967) in a study previously discussed. Present findings revealed significant differences between age groups in the performance of PR, ASM, MMT, B1, B2, B3 and B8 test items. It must be noted that in a one-way model which deleted the idiopathic etiology group, the only effect to be expected is a reduction in the degrees of freedom. This very possibly may result in a weakness in the model. However, since both models were utilized in the present study, any weaknesses that may have existed were insignificant. Reanalyzing the data by including the idiopathic classification, as in previous studies by Mykelbust (1946), ANOVA yielded similar results. In addition to the seven previously reported tests that resulted in significant differences between age groups, MMP, B4 and B7 were identified as being significant by the new model. In all cases, the performance pattern between groups remained constant. The oldest age group, 168-169 months old, consistently exhibited the highest performance on all variables. The middle two age groups, 120-143 and 144-167 months old, performed with near equal ability on the variables tested. The performance of the youngest age group, 96-119 months old, was uniformly lower. These findings are in direct agreement with many studies of the development of motor ability in both non-disabled and deaf populations (Carlson, 1972; Broadhead and Bruininks, 1982, 1983; Brunt and Broadhead, 1982). Carlson indicated there was not significant development in deaf children between ages seven and ten years; however, findings of the present study disagree. Many significant differences have been identified between the 96-119 month old group and the other three groups. Since Carlson's population had a maximum age of ten years it was impossible for him to identify other significant levels of motor ability development.

Hearing Loss Level

Examination of the results of the two-sample independent *t*-test revealed no significant difference in performance between the two groups on the basis of hearing loss. This finding indicates that the intensity of hearing loss does not affect the performance of manipulative tasks. There appears to be a minimal number of studies which determine the effect of hearing loss on motor performance. As this is the first known investigation into the effect hearing loss may have on the performance of manipulative skills, little comparison may be made with past studies. In assessing the motor ability of deaf children, Carlson (1971) grouped forty-eight students from the Kansas School for the Deaf into three groups based upon level of hearing loss. His findings support those of the present study in that the amount of hearing loss does not influence motor ability. Butterfield (1987) found positive but extremely low relationships between hearing loss and balance.

Sex Difference

Results of a two-sample independent *t*-test indicated a significant difference ($p < .05$) between males and females in the performance of only one manipulative task: GBL. This finding is reported with some reservation. Previous studies indicate similarity in male and female deaf subjects on the performance of motor abilities (Carlson, 1971; Lindsey and O'Neal, 1976; Brunt and Broadhead, 1982; Butterfield, 1987).

As is the case when performing a large number of *t*-tests, it is possible to identify up to five percent of the sample population significant at the 0.05 level even when there are not true differences. Therefore, it is suggested that further studies be conducted to identify the present finding as truly significant.

Correlation Testing

Pearson Product-Moment correlation coefficients exhibited a significant ($p < 0.05$) relationship between sixteen of the seventeen manipulative tests and the three variables of reaction time. Manipulative tests and reaction time performance both incorporate quick hand movements; therefore, the relationship revealed by the correlational coefficients is understandable. The discovery of GBL not being related to reaction time, movement time or response time is unexplainable. Presently, no studies exists that have identified a relationship between manipulative tests and reaction time variables; hence, the present findings contribute to the existing literature.

References

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

Broadhead, G. D. and Bruininks, G. D. (1982). Childhood motor performance traits on the short from Bruininks-Oseretsky Test.

Brunt, D. and Broadhead, G. D. (1982). Motor proficiency traits of deaf children. Research Quarterly for Exercise and Sport, 53, 236-238.

Butterfield, S. A. (1987). The influence of age, sex, hearing loss, etiology, and balance ability on the fundamental motor skills of deaf children. In International Perspectives on Adapted Physical Activity. (edited by M. E. Berrige and G. R. Ward), pp. 43-51. Human Kinetics Publishers, Champaign, Illinois.

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

Cratty, B. J., Cratty, I. J. and Cornell, S. (1986). Motor-planning abilities in deaf and hearing children. American Annals of the Deaf, 131, 281-284.

Grimsley, J. R. (1972). The effects of visual cueness and visual deprivation upon the acquisition and rate of learning of a balance skill among deaf individuals. Dissertation Abstracts International, 33, 3354A.

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

Mykelbust, H. R. (1946). Significance of etiology in motor performance of deaf children with special reference to meningitis. American Annals of the Deaf, 82, 249-258.

Mykelbust, H. R. (1964). The Psychology of Deafness. Grune & Stratton, New York.

Padden, D. A. (1959). Ability of deaf swimmers to orient themselves when submerged in water. Research Quarterly for Exercise and Sport, 30, 214-226.

Vance, P. C. (1968). Motor characteristics of deaf children. Dissertation Abstracts International, 29, 1145-1146A.

Weigersma, P. H. and Van der Velde, A. (1983). Motor development of deaf children. Journal of Child Psychology and Psychiatry, 24, 103-111.