STABILOMETER PERFORMANCE OF LEARNING DISABLED AND NONDISABLED BOYS

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF MASTER OF ARTS

IN THE GRADUATE SCHOOL OF THE

TEXAS WOMAN'S UNIVERSITY

COLLEGE OF

HEALTH, PHYSICAL EDUCATION AND RECREATION

BY

JAMES CLETUS SCHNEIDER, B.S.

DENTON, TEXAS

MAY, 1981

ACKNOWLEDGMENTS

The writer is deeply appreciative to Dr. Joan M. Moran, director of this thesis, for her patience, support, and valuable corrections.

Further acknowledgments are extended to Dr. Claudine Sherrill and Dr. Chester Gorton for their suggestions as members of the thesis committee.

DEDICATION

To Barbie, Ruth, Cletus, and the first of many little Schneiders; may they all share in the success that I am now experiencing.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION TO THE STUDY

Both the learning disabled and the clumsy child typically exhibit nonspecific awkwardness when attempting gross and fine motor tasks. In fact, there is at least a slightly higher percentage of clumsy children within the learning disabled population as compared to the normal population (Sherrill, 1977; Cratty, 1980). Because all human motion involves loss and recovery of balance, the relationship between equilibrium (balance) and motor performance is of particular significance in ameliorating awkwardness in learning disabled children. The major goal of this study, therefore, is to determine the balancing ability of learning disabled boys as measured by stabilometer performance.

As the child explores the environment through motor activities, he contacts and interacts with various elements in this environment and learning occurs. One of the basic movement generalizations needed to develop adequate information about the environment which surrounds the child is balance (Godfrey & Kephart, 1969).

> Motor experience can be observed as being the primary means by which a child initially gathers perceptual information about his world. In effect, the child moves to perceive, and perception through motion

> begins to give meaning and order to a world heretofore characterized by sensory chaos. (Moran & Kalakian, 1977, p. 270)

Motor experiences are important considerations in viewing the problems of learning disabled students. The motor handicapped and the motor unskilled demonstrate different degrees of abnormal motor activity paralleled with poor differential relaxation control during performance of fine and gross motor skills (French, 1978).

One problem when investigating motor skills is determining a highly reproducible task. Maintaining total body balance while standing on a first class lever is one such highly reproducible task which can be readily measured over specified time intervals by the stabilometer. According to Wade and Newell (1972), the stabilometer has received fairly extensive use as an instrument for investigating the effect of experimental variables on motor performance and allows a more precise evaluation of dynamic balance than any balance beam or balance board activity.

Literature directed toward seeking to determine motor patterns of children experiencing learning difficulties is inconclusive. Important reasons for this lack of information include: (a) small unrepresentative and vaguely described samples of learning disabled children have been the subjects for previous studies; (b) measures of motor

skills within the studies have been limited because the methods of measuring motoric behavior which discriminates between normal and low achieving students are extremely complex; and (c) conclusions of the studies have been based on limited evidence (Bruininks & Bruininks, 1972).

Research is needed to determine the magnitude of the relationship between equilibrium (balance) and motor performance of learning disabled children. The deficient motor skills of learning disabled students suggest the need to provide them with structured physical education training programs. Before such a program can be developed, a complete understanding of the motor characteristics of the learning disabled student must be acquired.

Purpose of the Study

The purpose of this study was to compare stabilometer performance of learning disabled and nondisabled boys.

Statement of the Problem

The problem of this study was to compare stabilometer performance of 9- to 11-year-old learning disabled and nondisabled boys. The subjects were students enrolled at Fairhill School and St. Mark's School of Texas located in Dallas, Texas, during the spring and summer of 1980. There were 30 learning disabled and 30 nondisabled subjects in the study.

Ten trials on the stabilometer were administered to each subject. The duration of each trial was 20 seconds, and the performance of the subject was measured by time-in-balance (TIB) for each trial. The average of the 10 trials was used to determine the performance score for each subject and to determine the difference between stabilometer performance of both groups. This score was also used to determine the relationship between age and stabilometer performance. To determine the difference between initial and final trial scores of both groups, the average of trials 1, 2, and 3 was used for the initial performance score, and the average of trials 8, 9, and 10 was used as the final performance score. Upon the basis of the findings, a conclusion was drawn to determine whether learning disabled boys were inferior to normal boys with respect to performance on the stabilometer.

Definitions and Explanations of Terms

For the purpose of clarification, the following definitions and explanations of terms were established for use throughout this study.

Learning Disabled Students

> "Learning disabled students" are students who demonstrate a significant discrepancy between academic achievement and intellectual abilities in one or more of the areas of oral expression, listening comprehension, written expression, basic reading skills,

> reading comprehension, mathematics reasoning, or spelling; for whom it is determined that the discrepancy is not primarily the result of visual handicap, hearing impairment, mental retardation, emotional disturbance, or environmental, cultural, or economic disadvantage; and for whom the inherent disability exists to a degree such that they cannot be adequately served in the regular classes of the public schools without the provision of special services. (Texas Education Agency, 1979, p. 4)

Stabilometer

The stabilometer is an instrument used to measure dynamic balance and to examine various aspects of motor learning. The stability platform of the stabilometer is mounted on a central pivot forming a first class lever. The stabilometer task involves standing on the stability platform and maintaining the platform in a horizontal position. Any deviation from this position activates the micro-switches which are adjustable from 0 to 5° of arc on each side of the center (balanced position). The durations of test and rest periods are monitored by means of a solid state recycling timer which provides a readout of the time for which the platform does not make contact with either bumper. The total time-in-balance can be computed from this readout. (Marietta Apparatus Company, 1973)

First Class Lever

> A lever is a bar or some other rigid structure hinged at one point, and to which forces are applied at two other points . . . . a lever in which the fulcrum lies between the points at which the force and resistance are applied is termed a first class lever. (Hay, 1973, p. 118)

Time-in-Balance

The performance criterion for a stabilometer trial length of 20 to 30 seconds is time-in-balance (TIB) (Melnich, 1971; Mumby, 1953; Singer, 1965). This refers to the length of time that the stability platform is not making contact with the micro-switches.

Dynamic Balance

Dynamic balance, as defined by Bass (1939), is the ability to keep one's equilibrium while changing from one balanced position to another or while changing through a series of positions taken consecutively.

Fairhill School

Fairhill School refers to a private school located in Dallas, Texas, that has been established for dealing directly with students who meet the characteristics of learning disabled children according to the Texas Education Agency.

St. Mark's School of Texas

St. Mark's School of Texas refers to a private boys' school located in Dallas, Texas, that has been established for dealing with students of normal grade placement.

Hypotheses of the Study

The following null hypotheses were examined at the .05 level of significance:

1. There is no difference between stabilometer performance of learning disabled and nondisabled boys.

2. There is no relationship between age and stabilometer performance of learning disabled and nondisabled boys.

3. There is no difference between initial and final trial scores of learning disabled and nondisabled boys with respect to stabilometer performance.

Limitations of the Study

The study was subject to the following limitations: (a) 30 learning disabled and 30 nondisabled male subjects between the ages of 9 and 11 years who were enrolled at either Fairhill School or St. Mark's School of Texas in Dallas, Texas, during the spring and summer of 1980; (b) the degree to which the subjects were representative of the populations from which they were drawn; (c) the parental permission to study the 60 subjects; (d) the previous motor experiences of the selected subjects; and (e) the validity and reliability of the test used.

CHAPTER II

REVIEW OF RELATED LITERATURE

An extensive investigation of related literature revealed that the present study in no way duplicates previous research. In fact, relatively little research has been published in the area of motor characteristics of the learning disabled child. The literature in this chapter, therefore, was limited to selected studies which gave information in the development of the study. The review of literature is categorized in this chapter under two sections: (a) Learning Disabled and (b) Stabilometer.

Learning Disabled

Pyfer and Carlson (1972) conducted an investigation to determine whether children classified as learning disabled should also be classified as having poor specific and general motor control which could be identified during preadolescence. The 28 subjects ranged in age from 5.1 to 13.6 years and were referred to the University of Kansas Perceptual Motor Clinic. The Lincoln-Oseretsky Motor Development Scale was used to determine the motor characteristics of the subjects. This test included both fine and gross motor tasks. The scores from the total test and

subtests were computed into means, standard deviations, and ranges. Pearson product-moment correlations between age and total score, and between age and each of the subtest scores were computed. The learning disabled subjects' total scores deviated very little from the normative standards.

The findings indicated that positive correlations existed between age and scores on each subtest evaluated. This indicated that children classified as learning disabled improved with age on the Lincoln-Oseretsky Motor Development Scale. The results from the General Static Coordination subtest revealed that the subjects were deficient in this area and their performance did not improve with age.

Walton (1974) investigated the effects of a remedial physical education program on learning disabled subjects with perceptual-motor deficits. The self-concept and games preference of the subjects were also studied. The experimental and control groups for the study were comprised of 23 subjects enrolled in classes for the learning disabled at Woodley School located in Hattiesburg, Mississippi, and 23 nondisabled subjects. Pretests on the variables were administered to both groups. The control group was posttested after a 6-week instructional period, whereas the

learning disabled group was posttested after a 2-week instructional period. To obtain the retention effects of the program, another posttest was conducted with the learning disabled group at the end of the experimental period.

Results from both an analysis of variance and an analysis of covariance indicated that the remedial physical education program utilized in the research enabled the learning disabled group to improve their physical performance. More specifically, the experimental group improved significantly in 4 of the 5 deficit variables and surpassed the control group's mean score in one variable at the posttest stage. At the conclusion of the experimental period, there was no improvement in self-concept and no more mature games preference for the experimental group.

Howard (1976) conducted a study which investigated the relationship between static and dynamic balance and the performance on time concept items of learning disabled and nondisabled subjects. A total of 50 learning disabled subjects with a mean age of 116.76 months and 50 nondisabled subjects with a mean age of 118.92 months took part in the study. Time concepts were measured by time items in the Orientation subtest of the Detroit Tests of Learning Aptitude and the Time Appreciation Test. Static and dynamic balance tasks comprised a 22-item motor battery which was used to determine high and low balance levels.

The time measure and time measures combined with balance ability and classification were statistically analyzed by a 2 x 2 factorial design for analysis of variance. Conclusions of the study were a result of post hoc analysis for simple effects using a t test for multiple comparisons. These findings indicated that the learning disabled subjects experienced difficulties with both static and dynamic balance and the time concept items as measured in the study.

Bruininks and Bruininks (1977) utilized the Bruininks-Oseretsky Test of Motor Proficiency (1977) to compare motor proficiency of 55 learning disabled and 55 nondisabled students. The learning disabled subjects' eligibility for inclusion in the study was based on (a) enrollment in a special school or summer program and (b) achievement significantly below expectation on the Woodcock Reading Mastery Tests and the Number, Addition, Subtraction, and Multiplication subtests of the Key Math Test. Contrast students for the study were drawn from the normative sample of the Bruininks-Oseretsky Test of Motor Proficiency. A three-factor design analysis of variance with repeated measures was used to compare motor performance of the two groups. The .05 level of significance was used for all comparisons.

Results indicated that the scores of the older subjects were significantly higher than the scores of the younger subjects. The fine motor composite, gross motor

composite, and total test performance scores of the learning disabled subjects were significantly lower than those of the nondisabled subjects.

Stabilometer

Bachman (1961) investigated the outcome of initial and final tests and the amount of learning on 2 10-trial large motor learning tasks involving the stabilometer and the ladder climb. The subjects were 160 males and 160 females ranging in age from 6 to 26 years. All subjects were enrolled in the public schools of Chico, California, and Chico State College.

The stabilometer task was comprised of 10 trials each of 30 seconds in duration with a 30-second intertrial rest period. The same time durations and trials were utilized for the ladder climb.

In the stabilometer task and the ladder climb, *t* ratios for differences between initial and final trials or gain in performance were significant at the .01 level. Significant improvement occurred for both sexes on the stabilometer and the ladder climb tasks. There was a 59% improvement for the stabilometer and a 44% improvement for the ladder climb. The results showed a zero correlation between performance on the two tasks. This indicated that motor performance was task specific.

Carron and Leavitt (1967) examined the effect that 6 days of practice on a large muscle motor-learning task had on learning and relearning trends, individual differences, intravariability, and reliability. The subjects were 30 boys aged 10 to 12 years who were enrolled in the California Children's Recreation School located in Berkeley, California. The subjects were tested on the stabilometer for 6 days with an interval of 1 to 2 days between each practice day. The test consisted of 12 trials of 30-second duration with a 30-second rest period between trials. A work adder recorded the movement of the stabilometer platform to the nearest 1/10 division.

Results indicated that individual differences or true score variance and within subject variance decreased with practice while performing the stabilometer task. When calculated as relative variations, both individual differences and within subject variance significantly increased. Reliability was shown to decrease with practice. The initial and 10th trial scores evidenced similarities to those reported by Bachman (1961) for boys aged 10 to 13 years. The performance loss which occurred with each 1-day layoff brought about a significant amount of relearning. Approximately four trials were needed to surpass the performance loss of the layoff period.

Eckert and Rarick (1976) investigated the use of the stabilometer to determine intraindividual variability, age, and sex differences of educable mentally retarded (EMR) and normal children. Five trials on the stabilometer were administered to 274 EMR children ages 6 to 13 years and 151 normal children ages 6 to 9 years. The five trials for each subject were recorded in work-adder units. The length of each trial period was 15 seconds with the intertrial rest period set at 30 seconds.

A repeated measures design analysis of variance and a *t*-test ratio indicated that older EMR boys and girls had slightly more board movement than younger EMR children, whereas there was a tendency for board movement to decrease with age for the normal age groupings. Normal children had significantly less board movement than EMR children at all age levels. There was a slight decrease in relative intraindividual variability with increasing age for both EMR and normal children.

Horgan (1977) investigated the effects of different supplementary auditory and visual feedback conditions on stabilometer performance. All of the 100 EMR children were administered 12 trials on the stabilometer. The IQ scores of the subjects ranged from 55 to 80, and their ages ranged from 7 through 16 years. The subjects were divided into 5

study groups: control, visual/in-balance, visual/out-of-balance, auditory/in-balance, and auditory/out-of-balance. Each of the 12-trial periods was 20 seconds in duration. The scores were recorded from measures of total time-in-balance (TIB) for each subject. Initial and final performance levels were obtained from the mean TIB of the first three and the last three trials. These trials were performed in the absence of all supplementary feedback.

A paired *t*-test design was used to make comparisons within each group from the initial to the final scores. The reliability coefficient obtained from the intraclass correlation performed on initial trials was .99, while coefficients obtained on final performance ranged from .94 to .98. Thus, under all conditions, task reliability was adequate. The analysis of variance performed for between group comparisons indicated that supplementary auditory and visual feedback training conditions increased stabilometer performance. The visual/time-in-balance group's rate of improvement was significantly greater than for any other group. This was revealed by the post hoc test.

CHAPTER III

PROCEDURES FOLLOWED IN THE DEVELOPMENT OF THE STUDY

The present study entailed a comparison between the stabilometer performance of learning disabled and nondisabled boys. The procedures followed in the development of the study are described in this chapter under the following headings: Sources of Data, Preliminary Procedures, Selection and Description of the Instrument, Selection of Subjects, Collection of Data, Treatment of Data, and Preparation of the Final Written Report.

Sources of Data

The data utilized in this study were gathered from documentary and human resources. Documentary sources included available books, periodicals, microfilms, published studies, and unpublished reports of research related to the study. The human sources of data included the investigator and 60 boys, ages 9 to 11 years, from Fairhill School and St. Mark's School of Texas in Dallas, Texas.

Preliminary Procedures

The investigator surveyed, studied, and assimilated the available documentary and selected human sources related to all aspects of the study. Permission to conduct the study was secured from the administrators of Fairhill School and St. Mark's School of Texas. Parental permissions were obtained for the students tested. The investigator sought and obtained permission to conduct the present study from the Human Subjects Review Committee at the Texas Woman's University, Denton, Texas.

The tentative outline for the thesis was developed and presented in a thesis meeting at the College of Health, Physical Education, and Recreation at Texas Woman's University, Denton, Texas. A copy of the revised and approved outline of the study was filed in the form of a Prospectus in the Office of the Provost of Graduate Studies at the Texas Woman's University, Denton, Texas.

Selection and Description of the Instrument

The instrument used in the collection of data for this investigation was selected according to the following criteria: (a) must be reliable, objective, and valid; (b) must be applicable to boys ages 9 to 11 years; (c) must be simple to organize, administer, score, and interpret for either classroom teachers or physical education specialists;

(d) must be a test of a highly reproducible dynamic balance task; and (e) must require equipment that is available or easily obtained.

The stabilometer test fulfilled all the criteria established for an instrument to measure dynamic balance of boys ages 9 to 11 years. The stabilometer has been one of the most extensively used instruments for measuring dynamic balance and for examining aspects of motor performance (Wade & Newell, 1972; Eckert & Rarick, 1976). The balancing task proved to be challenging for the subjects who were tested.

Selection of the Subjects

According to Cratty (1980), the learning disabled population in the United States is comprised of 70 to 90% boys (p. 170). The subjects for this study, therefore, were 9- to 11-year-old learning disabled and nondisabled boys. The learning disabled subjects were selected from Fairhill School, Dallas, Texas, and the nondisabled subjects were selected from St. Mark's School of Texas, Dallas, Texas. The following criteria were established for selection of subjects: (a) nondisabled subjects must be of normal grade placement; (b) disabled subjects must be identified as being learning disabled according to the definition established by the Texas Education Agency; and

(c) subjects must be free of physical abnormalities which would interfere with performance. Upon the basis of the criteria established, 30 learning disabled and 30 nondisabled boys were selected for this study. All subjects ranged in age from 9 years, 3 months to 11 years, 3 months.

Collection of Data

Prior to the initial testing dates, appropriate equipment and facilities had to be acquired. The testing was conducted in a secluded room with the test administrator and one subject in the room during the testing period. This was done to minimize possible distraction and peer pressure. A Marietta Apparatus Company Model 3-15A stabilometer was obtained from the Motor Performance Laboratory of Texas Woman's University. The degree of allowable platform rotation was set at $\pm 10^{o}$ by adjusting the microswitch on each side of the center position. The angle of tilt was then monitored by means of a degree of tilt indicator. The stabilometer task was demonstrated to each subject by the administrator who was the same for all subjects.

Ten trials of 20 seconds duration, with a 30-second intertrial rest period, were administered to each subject. After completion of each trial, the subject dismounted the stabilometer. The administrator then recorded the total

time-in-balance for that trial to the nearest 1/100th second.

Treatment of Data

The data obtained from the administration of the test were computed into performance scores by calculating the average of the subject's scores yielded by the 10 trials. The average time-in-balance of the first three trials and the last three trials was used as the criterion measures of initial and final performance levels, respectively. The range, standard deviation, mean, and standard error of the mean were then computed for each distribution. A two-way analysis of variance was employed to analyze performance differences among groups. A three-way analysis of variance was the statistical design used to determine significance between initial and final performance of both groups. No significant difference was found so a follow-up test was not used.

Preparation of the Written Report

The preparation of the final report of the study entailed writing each chapter, submitting it to the members of the thesis committee for suggestions and corrections, and revising each chapter in accordance with the recommendations of the committee members. The findings of the study were presented and interpreted, conclusions were drawn,

a bibliography of relevant research was included, and recommendations for further studies were made.

CHAPTER IV

PRESENTATION OF THE FINDINGS

This chapter includes the results of the statistical analysis of the data and a discussion of the findings. The purpose of the study was to compare stabilometer performance of learning disabled and nondisabled boys. All of the subjects were from the Dallas, Texas, area.

Data were collected through the administration of a 10-trial stabilometer test. The data were then treated statistically by a two-way analysis of variance with repeated measures on trials and a three-way analysis of variance with repeated measures. The results of the statistical treatment of the data are presented in tabular and narrative form.

Description of the Subjects

The 60 subjects used in the present study were enrolled in 2 private schools in Dallas, Texas, during the spring and summer of 1980. The learning disabled subjects were classified as learning disabled according to the definition established by the Texas Education Agency (1979), and the remaining 30 subjects were nondisabled. All subjects were free from physical abnormalities which might have interfered with

their performance on the stabilometer. Table 1 presents the data with respect to classification of subjects by age and condition.

Table 1

Classification of Subjects by Age and Condition

Age	Learning Disabled	Nondisabled	Total
9	10	10	20
10	10	10	20
11	10	10	20
Total	30	30	60

A study of Table 1 reveals that each group was comprised of 9-, 10-, and 11-year-old age divisions. Each division contained 10 subjects. Thus, both groups were symmetrical with respect to number of subjects.

The descriptive data for the two groups' performance on the stabilometer are shown in Table 2. These data were computed into performance scores by calculating the average of the subject's scores yielded by the 10 trials.

Table 2

Descriptive Data by Group and Age for Stabilometer Performance

Groups-Age	Range	Mean	SD	SE_m
LD Groups				
9-year-olds (n=10)	10.25 (7.22-17.47)	11.74	3.24	1.03
10-year-olds (n=10)	7.9 (7.71-15.61)	12.06	2.47	.78
11-year-olds (n=10)	5.13 (10.32-15.45)	12.46	1.48	.47
Total (n=30)	10.25 (7.22-17.47)	12.09	2.44	.44
NON-LD Groups				
9-year-olds (n=10)	5.66 (10.73-16.39)	13.96	2.11	.67
10-year-olds (n=10)	6.22 (10.32-16.54)	13.21	2.35	.74
11-year-olds (n=10)	5.71 (9.45-15.61)	11.72	2.14	.68
Total (n=30)	7.09 (9.45-16.54)	12.96	2.33	.42

LD - Learning Disabled; NON-LD - Nondisabled

As indicated in Table 2, the scores for the 9-year-old learning disabled subjects ranged from 7.22 seconds to 17.47 seconds. The mean score for the 9-year-old learning

disabled subjects was 11.74 seconds and the standard deviation was 3.24. The scores for the 9-year-old nondisabled subjects ranged from 10.73 seconds to 16.39 seconds. The mean score for this group was 13.91 seconds and the standard deviation was 2.11

According to Table 2, the scores for the 10-year-old learning disabled subjects ranged from 7.71 seconds to 15.61 seconds with a mean score of 12.06 seconds. The standard deviation for the 10-year-old learning disabled subjects was 2.47. The scores for the 10-year-old nondisabled subjects ranged from 10.32 seconds to 16.45 seconds. The mean score was 13.21 seconds and the standard deviation for this group was 2.11.

As indicated in Table 2, the scores for the 11-year-old learning disabled subjects ranged from 10.32 seconds to 15.45 seconds. The mean score was 12.46 seconds and the standard deviation was 2.11. The scores for the 11-year-old nondisabled subjects ranged from 9.45 seconds to 15.16 seconds with a mean score of 11.72. The standard deviation was 2.14.

The scores for all age levels within the learning disabled group ranged from 7.22 seconds to 17.47 seconds. The mean score was 12.09 seconds and the standard deviation was 2.44. The scores for all age levels within the nondisabled

group ranged from 9.45 seconds to 16.54 seconds. The mean score was 12.96 and the standard deviation was 2.33. According to Table 2, with the exception of the 11-year-old group, the nondisabled subjects had greater mean scores than the learning disabled subjects.

The descriptive data for initial and final performance scores with respect to group and age are presented in Tables 3 and 4.

Table 3

Descriptive Data of Learning Disabled Group by Age for Initial and Final Performance

Age	Trials	Range	Mean	SD	SE_m
9-year-olds (n=10)	Initial	11.1 (6.19-17.29)	10.48	3.12	.98
	Final	9.04 (7.89-16.93)	13.04	3.14	.99
10-year-olds (n=10)	Initial	8.26 (6.32-14.58)	11.04	2.70	.85
	Final	7.48 (9.36-16.84)	12.47	2.43	.77
11-year-olds (n=10)	Initial	8.86 (7.56-16.42)	11.25	2.61	.83
	Final	7.07 (10.58-17.65)	13.77	2.24	.71
Total (n=30)	Initial	11.10 (6.19-17.29)	10.92	2.81	.51
	Final	9.76 (7.89-17.65)	13.09	2.60	.47

The initial performance score was the mean value of trials 1, 2, and 3 of the stabilometer test. The final performance score was the mean value of trials 8, 9, and 10. A study of Table 3 indicated that the scores for the 9-year-old learning disabled subjects ranged from 6.19 seconds to 17.29 seconds for the initial trial and 7.89 seconds to

16.93 seconds for the final trial. The means for the group were 10.48 seconds for the initial trial and 13.04 seconds for the final trial. The standard deviations were 3.12 for the initial trial and 3.14 for the final trial.

According to Table 3, the scores for the 10-year-old learning disabled subjects ranged from 6.32 seconds to 14.58 seconds for the initial trial and 9.36 seconds to 16.84 seconds for the final trial. The means for the group were 11.04 seconds for the initial trial and 12.47 seconds for the final trial. The standard deviations were 2.70 for the initial trial and 2.41 for the final trial.

As indicated in Table 3, the scores for the 11-year-old learning disabled subjects ranged from 7.56 seconds to 16.42 seconds for the initial trial and 10.58 seconds to 17.65 seconds for the final trial. The means for the group were 11.25 seconds for the initial trial and 13.77 seconds for the final trial. The standard deviations were 2.61 for the initial trial and 2.24 for the final trial.

The scores for all age levels within the learning disabled group ranged from 6.19 seconds to 17.29 seconds for the initial trial and 7.89 seconds to 17.65 seconds for the final trial. The means for the group were 10.92 seconds for the initial trial and 13.09 seconds for the final trial.

The standard deviations were 2.81 for the initial trial and 2.60 for the final trial.

Table 4

Descriptive Data of Nondisabled Group by Age for Initial and Final Performance

Age	Trials	Range	Mean	SD	SE_m
9-year-olds (n=10)	Initial	6.96 (9.78-16.83)	13.65	2.30	.73
	Final	4.59 (12.70-17.29)	14.68	2.45	.78
10-year-olds (n=10)	Initial	8.95 (7.13-16.08)	12.23	2.70	.85
	Final	7.16 (9.23-16.39)	13.62	2.41	.76
11-year-olds (n=10)	Initial	6.01 (9.22-15.23)	12.13	2.32	.73
	Final	7.80 (9.60-17.40)	12.04	2.97	.94
Total (n=30)	Initial	9.70 (7.13-16.83)	12.67	2.44	.44
	Final	8.17 (9.23-17.40)	13.44	2.61	.48

A study of Table 4 indicated that the scores for the nondisabled 9-year-old subjects ranged from 9.78 seconds to 16.83 seconds for the initial trial and 12.70 seconds to 17.29 seconds for the final trial. The means for the group

were 13.65 seconds for the initial trial and 14.68 seconds for the final trial. The standard deviations were 2.30 for the initial trial and 2.45 for the final trial.

According to Table 4, the scores for the nondisabled 10-year-old subjects ranged from 7.13 seconds to 16.08 seconds for the initial trial and 9.23 seconds to 16.39 seconds for the final trial. The means for the group were 12.23 seconds for the initial trial and 13.62 seconds for the final trial. The standard deviations were 2.70 for the initial trial and 2.41 for the final trial.

As indicated in Table 4, the scores for the 11-year-old nondisabled subjects ranged from 9.22 seconds to 15.23 seconds for the initial trial and 9.60 seconds to 17.40 seconds for the final trial. The means for the group were 12.13 seconds for the initial trial and 12.04 seconds for final trial. The standard deviations were 2.32 for the initial trial and 2.97 for the final trial.

The scores for all age levels within the nondisabled group ranged from 7.13 seconds to 16.83 seconds for the initial trial and 9.23 seconds to 17.40 seconds for the final trial. The means for the group were 12.67 seconds for the initial trial and 13.44 seconds for the final trial. The standard deviations were 2.44 for the initial trial and 2.61 for the final trial.

Comparison of Groups

To determine if significant differences existed between groups and age on the stabilometer test, a two-way analysis of variance with repeated measures was computed. The results appear in Table 5.

Table 5

Analysis of Variance for Stabilometer Performance

Source	df	SS	MS	F
Group	1	11.388	11.388	2.05
Age	2	6.000	3.000	.05
Group x Age	2	22.685	11.343	2.04
Error	54	300.385	5.563	

$F_{.95}(1,54) = 4.02$

$F_{.95}(2,54) = 3.18$

According to Table 5, an F ratio of 3.18, with 2 and 54 degrees of freedom, was required for significance at the .05 level. Because the F values obtained were less than 3.18, the stabilometer performance test results disclosed no significant difference between groups, between ages, or for group by age interaction.

Table 6 presents the results of a three-way analysis

of variance with repeated measures to determine differences between groups and age on the initial and final performance scores of the stabilometer test.

Table 6

Analysis of Variance for Initial and Final Stabilometer Trial Scores

Source	df	SS	MS	F
Group	1	33.149	33.149	2.83
Age	2	11.029	5.546	0.47
Group x Age	2	40.306	20.153	1.72
Error	54	633.560	11.733	
Trials	1	65.225	65.225	30.53*
Trials x Group	1	14.553	14.553	6.81*
Trials x Age	2	1.761	0.881	0.41
Trials x Group x Age	2	8.389	4.194	1.96
Error	54	115.359	2.136	

*$F_{.95}(1,54) = 4.02$

*$F_{.95}(2,54) = 3.18$

According to Table 6, an F ratio of 4.02, with 1 and 54 degrees of freedom, was required for significance at the .05 level. The F value of 30.53 for interaction between

trials was significant. The final trial mean performance score for both groups was 1.4 seconds greater than the initial trial mean performance score. As indicated in Table 6, an F value of 6.18 for trials by group interaction was significant. The nondisabled subjects had an initial performance score that was 1.75 seconds greater than the learning disabled subjects' initial performance score. The nondisabled subjects' final performance score was only .36 seconds greater than the learning disabled subjects' final performance score. The nondisabled subjects' performance increased .78 seconds from initial to final trials. The learning disabled subjects' performance increased 2.17 seconds from initial to final trials. When compared to the nondisabled group, the learning disabled subjects significantly increased their performance from initial to final trials. A further study of Table 6 indicated that there were no significant differences between trial by age, or trial by group by age as measured by a three-way analysis of variance with repeated measures on trials for initial and final trial scores on the stabilometer test.

The significant trials by group interaction is further demonstrated in Figure 1.

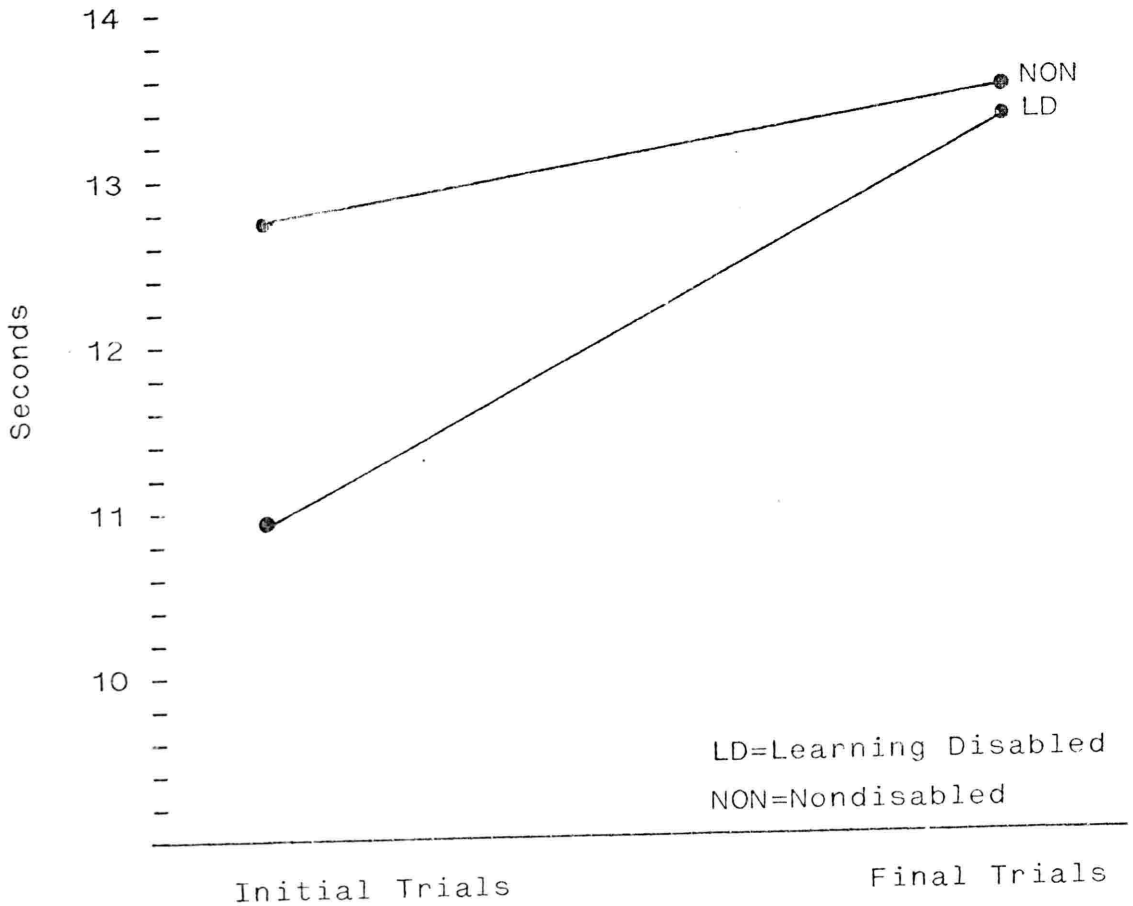

Figure 1. Initial and final trial scores by groups.

Figure 1 further graphically describes the difference between the two groups. The initial performance score for all age levels within the learning disabled group was 10.92 seconds and the final performance score was 13.09 seconds. The initial performance score for all age levels within the nondisabled group was 12.67 seconds and the final performance score was 13.45 seconds.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDIES

The learning disabled child typically exhibits nonspecific awkwardness when attempting gross and fine motor tasks. This deficiency in the motor domain suggests the need for structured physical education programs. Howard (1976) found that learning disabled subjects experienced difficulties with both static and dynamic balance. Later research by Bruininks and Bruininks (1977) reported that learning disabled students performed significantly lower than nondisabled students on the Bruininks-Oseretsky Test of Motor Proficiency. Pyfer and Carlson's (1972) research indicated, however, that the performance of learning disabled children as measured by the Lincoln-Oseretsky Motor Development Scale improves with age. Walton's (1974) research indicated that a remedial physical education program could improve the physical performance of learning disabled subjects. Additional research is needed in all areas of motor performance of learning disabled children, including balance.

One motor activity that may aid in determining the

balancing ability of learning disabled students was investigated in this study. This motor activity was maintaining balance while standing on a stabilometer. The investigation entailed the comparison of stabilometer performance of learning disabled and nondisabled boys. The study included two groups, each comprised of 30 boys, ages 9 to 11 years, who were enrolled at two private schools in Dallas, Texas, during the spring and summer of 1980. The groups were classified as learning disabled and nondisabled. Both groups participated in a 10-trial stabilometer test with each trial being 20 seconds in duration with a 30-second intertrial rest period.

The data collected from the 10 trials were calculated into a mean performance score. The mean value of trials 1, 2, and 3 served as the initial performance score and the mean value of trials 8, 9, and 10 served as the final performance score. To determine if there were any significant differences between age or groups, a two-way analysis of variance with repeated measures was computed. A three-way analysis of variance with repeated measures was computed to determine significant differences between the groups on initial and final performance scores.

The two-way analysis of variance revealed that:

1. There was no significant difference between the

means of both groups with respect to stabilometer performance.

2. There were no significant differences between age groups with respect to stabilometer performance.

3. There was no significant difference between age and groups with respect to stabilometer performance.

The three-way analysis of variance revealed that:

1. There was a significant difference between the initial and final trial performance scores. The final performance scores increased, indicating that learning occurred over trials.

2. There was a significant difference in the interaction between trials by groups with respect to initial and final trial performance scores. The greatest difference occurred with the learning disabled group.

3. There was no significant difference between mean performance scores of learning disabled and nondisabled groups with respect to initial and final trial performance.

4. There was no significant difference between the mean performance scores of age groups with respect to initial and final trial performance scores.

5. There was no significant difference between the mean performance scores for ages and groups on initial and final trial performance scores.

6. There was no significant difference in the interaction between trials by age with respect to initial and final trial performance values.

7. There was no significant difference in the interaction between trial by group by age with respect to initial and final trial performance values.

Based upon the findings of the study, the investigator accepted the following hypotheses at the .05 level of significance:

1. There is no difference between stabilometer performance of learning disabled and nondisabled boys.

2. There is no relationship between age and stabilometer performance of learning disabled and nondisabled boys.

Based upon the findings of the study, the investigator rejected the following hypothesis at the .05 level of significance:

1. There is no difference between initial and final trial scores of learning disabled and nondisabled boys with respect to stabilometer performance.

Conclusion to the Study

It was concluded that learning disabled boys, ages 9 to 11 years, who were selected from a private school specifically established for the learning disabled student, performed as well as nondisabled boys of the same age who

were of normal grade placement. It appeared that the student labeled "learning disabled" was not handicapped in his performance of a highly reproducible dynamic balance skill such as a stabilometer test.

Discussion

After conducting the study, it was apparent that several factors may have prevented a clear or definitive interpretation of the findings. Since the learning disabled subjects met the criteria of learning disabilities established by the Texas Education Agency, the data were presumed to include a well represented sample of a learning disabled and nondisabled population. However, difference in experience and exposure to a structured physical education program which incorporated balance skills and activities may have been an influencing factor in the results obtained from each group. The number of trials on the stabilometer, the duration of the trials, and the intertrial rest period might have been influencing factors.

A further explanation may have been the fact that the investigator for the present study was also the adapted physical education specialist for the learning disabled subjects. This may have developed a bias favoring these students over the nondisabled students. Another possibility is that the number of subjects participating in the study

may have been insufficient for a significant difference to be found between groups.

Recommendations for Further Studies

After conducting the stabilometer performance test with learning disabled and nondisabled subjects and analyzing the results of the present study, the investigator recommends that the following studies be undertaken:

1. A study similar to the present one with more subjects participating at each age level in both groups.

2. A study similar to the present one with the inclusion of female subjects.

3. A study similar to the present one using a different number of trials and a longer duration for the trial period.

4. A comparative study of stabilometer performance of learning disabled subjects trained under differential feedback conditions.

APPENDIX A

PERMISSION LETTERS

FAIRHILL SCHOOL

August 13, 1980

Physical Education Department
Graduate School Division
Texas Woman's University
Denton, Texas

To Whom It May Concern:

This is to verify that prior to any testing on any student enrolled at the Fairhill School, James Schneider discussed and reviewed in detail, all testing procedures with me. During the course of our several discussions any difficulties were remedied and consideration was given to the most appropriate times and means of proceding with the research.

All parents of students were notified of the intended testing and permission was received from them. Any questions from them were directed to either Jim Schneider or myself.

If there are any additional questions concerning this research or the testing procedures please do not hesitate to contact me.

Sincerely,

Connie S. Wilson, Ph.D.
Director of Psychological Services

6039 CHURCHILL WAY / DALLAS, TEXAS 75230 / (214) 233-1026

ST. MARK'S SCHOOL OF TEXAS
10600 PRESTON ROAD
DALLAS, TEXAS 75230

Day Camp

July 22, 1980

The Human Research Community
Texas Women University

To Whom It May Concern:

The St. Mark's Day Camp has taken full responsibility and liability for the testing conducted by Mr. James Schneider. The testing was conducted on a stabilometer at the Day Camp on Wednesday, July 16th.

If you need further information concerning the test please contact me at 363-6491.

Respectfully,

Bob Kohler
Director of Camps

BK/lj

APPENDIX B

PARENTAL PERMISSION FORM

PERMISSION FORM

1. I hereby authorize James C. Schneider to perform the following procedures:

   To test my child on the stabilometer (balancing board) and to use the information obtained for his study. The student will stand on the balancing board and attempt to maintain it in a horizontal position. The length of the test is approximately 5 minutes.

2. I understand that this procedure will benefit my child by determining his/her ability to perform a particular balance task.

3. I understand that - No medical service or compensation is provided to subjects by the university as a result of injury from participation in the research.

4. An offer to answer all of my questions regarding the study has been made. If alternative procedures are more advantageous to me, they have been explained. I understand that I may terminate my participation in the study at any time.

_____
Student's Name

Signatures (one required)

_____ Father	_____ Date
_____ Mother	_____ Date
_____ Guardian	_____ Date
_____ Witness (one required)	_____ Date

APPENDIX C

RAW DATA

TABLE A

Raw Data for 9-Year-Old Learning Disabled Subjects

Subject	Mean	Trials 1	2	3	4	5	6	7	8	9	10	Initial	Final
1	12.72	7.10	14.33	14.83	10.27	15.35	6.82	15.05	16.15	12.80	14.51	12.09	14.44
2	12.28	9.49	9.35	9.41	14.43	10.23	15.80	11.73	12.43	15.20	14.68	9.42	14.10
3	8.59	8.88	7.02	9.24	6.09	9.00	6.58	8.83	10.90	9.61	9.76	8.38	10.09
4	7.71	4.34	6.42	10.69	4.57	7.38	7.12	7.63	9.38	10.41	9.13	7.15	9.64
5	17.47	17.52	17.54	16.80	19.50	18.38	14.84	19.50	17.05	13.90	19.60	17.29	16.88
6	13.61	13.90	7.80	11.88	14.48	18.91	14.67	11.62	15.69	13.88	13.30	11.19	14.29
7	10.38	10.94	10.22	9.12	9.79	9.39	9.83	10.97	12.14	8.91	12.44	10.09	11.17
8	13.08	11.29	12.03	9.08	11.29	11.37	16.56	14.21	15.42	15.47	14.08	10.80	14.99
9	7.22	7.54	5.13	5.91	7.50	7.93	8.45	6.07	8.74	8.28	6.66	6.19	7.89
10	14.35	13.80	11.08	11.65	11.71	13.19	18.78	12.50	17.61	18.80	14.37	12.18	16.93

Table B

Raw Data for 10-Year-Old Learning Disabled Subjects

Subject	Mean	Trials 1	2	3	4	5	6	7	8	9	10	Initial	Final
1	9.58	5.54	6.58	7.34	8.83	12.57	13.13	8.50	9.60	12.28	11.40	6.49	11.09
2	14.90	12.65	12.23	18.86	13.90	17.03	13.64	17.93	17.45	14.26	11.06	14.58	14.25
3	15.61	10.75	9.66	14.88	17.22	17.53	18.77	16.52	16.34	17.80	16.60	11.76	16.84
4	13.18	14.01	10.17	14.72	12.31	15.83	18.75	11.76	13.60	9.12	11.48	12.97	11.40
5	9.79	10.53	9.90	10.90	9.86	9.92	8.39	10.36	7.68	10.76	9.63	10.44	9.36
6	13.68	13.40	9.40	14.78	13.64	14.00	16.97	12.20	13.57	14.94	13.98	12.53	13.92
7	12.05	8.52	13.58	13.93	11.36	13.00	10.78	10.02	14.92	10.92	13.44	12.01	13.09
8	11.72	12.10	12.67	12.76	12.31	11.45	12.82	9.13	11.32	13.30	9.32	12.51	11.32
9	12.36	11.60	9.62	11.17	12.78	10.05	14.70	10.99	11.68	16.96	14.09	10.80	14.24
10	7.71	5.89	6.81	6.27	7.23	6.08	9.68	7.76	10.36	7.81	9.25	6.32	9.14

Table C

Raw Data for 11-Year-Old Learning Disabled Subjects

Subject	Mean	Trials 1	2	3	4	5	6	7	8	9	10	Initial	Final
1	10.32	6.10	7.15	9.42	10.25	8.26	15.49	13.33	11.27	12.30	9.64	7.56	11.08
2	13.38	10.05	11.13	14.56	11.89	10.49	7.71	17.38	16.21	17.64	16.23	11.91	16.86
3	11.04	9.38	9.72	9.40	10.44	6.53	14.93	11.06	12.76	12.01	14.14	9.50	12.97
4	11.33	15.07	11.10	10.81	13.96	11.78	7.89	11.39	12.56	7.05	12.13	12.33	10.58
5	13.52	8.47	11.90	8.97	16.88	15.40	16.05	12.42	14.52	12.57	17.98	9.78	15.02
6	12.47	14.42	11.04	13.70	13.69	10.44	11.36	10.18	12.25	13.46	14.16	13.05	13.29
7	11.89	9.44	9.04	7.36	11.45	16.93	12.09	10.72	12.93	12.20	16.77	8.61	13.97
8	15.45	16.32	14.45	18.49	10.43	7.02	17.86	16.96	17.47	16.34	19.15	16.42	17.65
9	12.11	9.24	12.25	9.34	9.22	14.25	12.70	15.00	13.39	13.54	12.12	10.28	13.02
10	13.24	10.61	17.21	11.31	12.57	14.09	14.20	12.51	14.50	13.48	11.91	13.04	13.30

Table D

Raw Data for 9-Year-Old Nondisabled Subjects

Subject	Mean	Trials 1	2	3	4	5	6	7	8	9	10	Initial	Final
1	14.92	9.82	18.46	15.80	13.93	15.35	17.68	14.69	13.51	19.18	10.81	14.69	14.50
2	16.36	17.43	17.18	15.87	14.44	14.32	17.67	15.62	19.15	19.56	17.91	16.83	18.87
3	16.39	11.38	18.45	17.63	17.76	15.25	16.89	14.69	16.86	15.33	18.69	15.82	17.29
4	10.73	9.37	11.14	13.50	9.25	9.58	12.53	10.30	10.56	13.22	7.88	11.34	10.55
5	13.09	13.20	10.96	14.66	13.89	14.92	12.00	9.84	14.21	13.25	14.00	12.94	13.82
6	14.37	13.59	15.90	13.83	13.78	10.65	15.63	15.62	15.95	16.63	12.07	14.44	14.88
7	11.44	12.01	9.11	8.21	13.20	9.08	12.18	11.26	15.09	16.27	8.03	9.78	13.13
8	14.06	14.21	11.47	16.41	10.44	16.10	16.89	16.99	11.04	15.10	11.96	14.03	12.70
9	11.92	11.82	9.41	11.93	9.54	10.21	12.70	11.12	14.16	12.61	15.69	11.05	14.15
10	16.33	16.11	16.33	14.25	18.20	17.29	16.48	13.74	18.68	15.42	16.76	15.56	16.92

Table E

Raw Data for 10-Year-Old Nondisabled Subjects

Sub-Ject	Mean	Trials 1	2	3	4	5	6	7	8	9	10	Ini-tial	Fi-nal
1	13.62	10.72	14.28	15.73	12.12	14.65	13.73	10.75	12.63	14.51	17.03	13.58	14.72
2	10.32	9.67	8.05	10.77	8.64	8.83	14.65	8.34	11.22	11.55	11.49	9.50	11.42
3	15.40	14.17	12.48	14.67	17.50	13.96	15.87	17.39	16.64	15.25	16.11	13.77	16.00
4	10.36	8.03	6.04	7.31	12.71	13.07	10.01	8.12	17.34	10.20	10.80	7.13	12.78
5	16.54	13.03	17.59	13.64	18.24	17.46	18.00	18.22	17.49	15.64	16.05	14.75	16.39
6	13.88	14.28	10.40	12.88	13.59	14.53	13.64	14.83	15.38	14.48	14.78	12.52	14.88
7	10.34	10.32	8.32	12.43	10.29	11.20	10.62	12.16	10.79	9.72	7.17	10.36	9.23
8	12.16	9.85	12.67	10.55	12.62	11.32	14.24	10.03	13.14	12.39	14.82	11.02	13.45
9	15.93	13.72	16.79	17.74	13.41	15.20	16.51	17.88	17.44	12.98	17.67	16.08	16.03
10	13.51	13.80	14.11	12.88	15.30	16.73	14.81	13.60	13.71	10.03	10.13	13.60	11.29

Table F

Raw Data for 11-Year-Old Nondisabled Subjects

Subject	Mean	Trials 1	2	3	4	5	6	7	8	9	10	Initial	Final
1	15.16	13.41	14.68	15.04	12.32	15.52	13.61	14.80	18.30	15.91	18.00	14.38	17.40
2	9.94	9.79	9.88	8.53	4.85	9.92	12.60	9.80	11.81	11.33	10.84	9.40	11.34
3	9.88	10.12	10.12	8.51	7.04	12.62	11.19	7.67	10.56	10.11	10.85	9.58	10.51
4	15.14	16.11	15.05	14.53	14.08	13.08	16.13	14.32	15.17	18.03	14.87	15.23	16.02
5	9.50	9.83	11.70	9.51	9.95	9.28	8.01	14.23	6.63	8.27	7.58	10.37	7.49
6	11.61	12.79	13.25	12.54	13.85	8.40	9.44	12.23	10.22	11.50	11.86	12.86	11.19
7	9.45	5.16	10.42	12.07	8.43	9.45	10.95	9.19	9.00	11.33	8.48	9.22	9.60
8	12.56	11.87	10.78	13.78	15.31	13.33	12.89	13.88	9.85	11.33	12.59	12.14	11.26
9	15.10	10.68	13.45	17.85	17.02	18.55	14.50	17.13	13.73	12.80	15.31	13.99	13.95
10	11.87	16.94	14.58	11.08	10.20	9.76	11.21	9.94	10.51	13.90	10.53	14.20	11.65

BIBLIOGRAPHY

Bibliography

Bachman, J. C. Motor learning and performance as related to age and sex in two measures of balance coordination. Research Quarterly, 1961, 32, 123-37.

Bass, R. E. An analysis of the components of tests of semicircular function and of static and dynamic balance. Research Quarterly, 1939, 10, 247-59.

Bruininks, B. L., & Bruininks, R. H. Motor proficiency of learning disabled and nondisabled students. Perceptual and Motor Skills, 1977, 44, 1131-37.

Carron, A. V., & Leavitt, J. L. Effects of practice upon individual differences and intra-variability in a motor skill. Research Quarterly, 1967, 39, 470-5.

Cratty, B. J. Adapted physical education for handicapped children and youth. Denver: Love Publishing Co., 1980.

Eckert, H. M., & Rarick, G. L. Stabilometer performance of educable mentally retarded and normal children. Research Quarterly, 1976, 47, 619-23.

Ferguson, G. A. Statistical analysis in psychology and education (4th ed.). New York: McGraw-Hill Book Co., 1976.

French, S. N. Electromyographic biofeedback for tension control during gross motor acquisition. Perceptual and Motor Skills, 1978, 47, 883-9.

Godfrey, B. B., & Kephart, N. C. Movement patterns and motor education. New York: Appleton-Century-Crofts, 1969.

Hay, J. C. The biomechanics of sports techniques. Englewood Cliffs, N.J.: Prentice Hall, Inc., 1973.

Horgan, J. S. Stabilometer performance of educable mentally retarded children under differential feedback conditions. Research Quarterly, 1977, 48, 711-16.

Howard, N. A. The relationship between balance and the ability to perform on items involving time concepts in normal and school identified children with learning disabilities (Doctoral dissertation, George Peabody College for Teachers, 1976). Dissertation Abstracts International, 1977, 37, 7073A-7074A. (University Microfilms No. 77-10,720)

Marietta Apparatus Company. Instruction Manual. Marietta, Ohio: Author, 1973.

Melnick, M. J. Effects of overlearning on the retention of a gross motor skill. Research Quarterly, 1971, 42, 60-9.

Moran, J. M., & Kalakian, L. H. Movement experiences for the mentally retarded or emotionally disturbed child (2nd ed.). Minneapolis: Burgess Publishing Co., 1977.

Mumby, H. H. Kinesthetic acuity and balance related to wrestling ability. Research Quarterly, 1953, 24, 60-9.

Pyfer, J. L., & Carlson, B. R. Characteristic motor development of children with learning disabilities. Perceptual and Motor Skills, 1972, 35, 291-6.

Sherrill, C. Adapted physical education and recreation: A multidisciplinary approach. Dubuque, Iowa: Wm. C. Brown Co., 1977.

Singer, R. N. Effect of spectators on athletes and non-athletes performing a gross motor task. Research Quarterly, 1965, 36, 473-82.

Texas Education Agency. Policies and administrative procedures for the education of handicapped students. Austin: Author, 1979.

Wade, M. G., & Newell, K. M. Performance criteria for stabilometer learning. Journal of Motor Behavior, 1972, 4, 231-9.

Walton, H. H. A study of motor deficits and remediation for learning disabled students through remedial physical education (Doctoral dissertation, University of Southern Mississippi, 1974). Dissertation Abstracts International, 1975, 35, 6499A. (University Microfilms No. 75-9614,138)