A COMPARISON OF PERFORMANCE ON FOUR GROSS MOTOR SKILL TESTS
OF DYSLExic AND NON-DYSLExic BOYS AGED NINE
THROUGH TWELVE

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A COMPARISON OF PERFORMANCE ON FOUR GROSS MOTOR SKILL TESTS
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THROUGH TWELVE

THESIS

Presented to the Graduate Council of the
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By

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CHAPTER I

INTRODUCTION

Scholastic achievement and academic progress during his formal education are virtually dependent upon a child's ability to read. Any condition, then, which inhibits normal reading development or impairs the child's ability to comprehend printed language must be considered quite serious.

Surveys of large populations of students reveal reading problems are more prevalent than can be attributed to obvious organic disabilities. This is a source of great concern for administrators and teachers alike.

Although the problem of dyslexia is one of interest to educators, there is presently an increasing amount of interdisciplinary research in the broad area of learning problems. As a result, overlapping and confusion develop over the variety of technical labels being used. Such is the case with the term dyslexia, which is becoming a "catch-all" phrase for reading problems which cannot readily be attributed to obvious causes.

A literal analysis of dyslexia reveals the Greek prefix dys (meaning hard or ill) with the root lexis (meaning speech or word). Word difficulty or reading difficulty can therefore encompass a variety of problems. According to
Dauzat (4, p. 631), use of the term dyslexia to describe reading difficulties has become so general that it can be applied to about 20 to 40 percent of the school population.

After a thorough review of the inconsistencies of the definitions being used by medical and educational researchers, Adams (1, p. 618) suggested that future writers make clear the basis for their use of the term dyslexia.

Dyslexia, as it is being used in the present investigation, is explained by Waites as follows:

Specific dyslexia is defined as a disability of central origin with disorders in reading, writing, spelling and sometimes, verbal expression (5, p. 11).

Money (8, p. 4) expressed a similar view but added that specific dyslexia occurs when the child is unable to learn to read with proper facility despite normal intelligence, intact senses, proper instruction, and normal motivation.

According to Critchley (2, p. 1), the first reference to a dyslexic-type occurred in the seventeenth century. Since that time, there has been tremendous progress made in both recognizing and understanding the many kinds of learning problems.

The causes suggested by various researchers are numerous. Medical authorities have found that neurological disorders such as dyslexia and minimal brain damage (M.B.D.) are linked to problem pregnancies and/or prematurities. Physical or chemical insults to the embryo during or after
birth have been linked to such disorders. However, not infrequently, the true cause of the reading problem cannot be traced (5, pp. 2-5).

Problems of visual acuity, auditory defects or in general any sensory defects which lend themselves to language problems have also been considered as contributors to the condition of dyslexia (1, 2, 6).

Educators tend to add other possible causes of dyslexia which are not related to any physical malady. Adams (1, p. 619), in a summary article, states that dyslexia may be congenital, developmental, and specific. The phonetic structure of the language also influences severity of dyslexia. Dauzat (4, p. 631) states that cultural deprivation, while not necessarily a cause of specific dyslexia, may produce the physical factors which affect reading development. Bilingualism, differentiation in behavioral standards, and mobility are also culturally related factors which pose obstacles to learning.

The number of children who possess language difficulty can only be estimated, but some authorities feel that as many as one-third of the total school-age population are unrecognized dyslexics. Cole and Walker (10) did a study of a population sample and found 25 percent affected by some kind of language difficulty. The number of students afflicted varies according to the limitations of the definition of dyslexia as a part of the whole range of learning
disabilities. Specific dyslexia is more prominent in males than in females, with the degree of severity varying.

Crosby (3, p. 74) claims dyslexia occurs four to five times more frequently in males. While dyslexia has some relationship to left-handedness, the relationship is unclear. Crosby (3, p. 74) also stated that in one quarter of all the cases, dyslexia is believed to be genetic in origin—this is not to say dyslexia must be inherited.

Symptoms of dyslexia are varied. Sets of symptoms may be few in number and simple, a series of symptoms, or a combination of both. Poor handwriting, poor balance, poor rhythm, difficulties in running, throwing, catching, and walking attributed to muscle incoordination have been accepted as symptoms. When reading, the dyslexic may perceive "saw" as "was" or he may reverse several words in a sentence, and usually has a difficult time copying written material. The afflicted child may confuse right from left, front from back. Failure becomes a familiar term for the dyslexic. Naturally, all of these symptoms contribute to the development of emotional and behavioral problems which compound the frustration of the dyslexic's condition.

As is true with many of the various learning disabilities, a great deal of research is being done in terms of the diagnoses of dyslexia and appropriate methods for helping children to overcome the problem.
As various tests are being designed to measure the severity of blockage so are various techniques of treatment being designed for amelioration of the condition of dyslexia. Just as each case of dyslexia is unique, so each treatment must be unique. Crosby (3) and Kephart (6) point towards multiple and various approaches concentrating upon development of gross and fine motor skills as well as pure reading remediation. Waites (10, p. 1) expresses a need for cooperative research by professionals in medicine, psychology, special education, nursing, social science, physical education, occupational therapy, hearing and speech therapy to formulate a pattern of treatment effective for dealing with the problem of dyslexia.

Statement of the Problem

Many people who have done research in the area of learning disabilities have referred to the importance of the motor development of children who have learning problems. Very often the academic difficulties possessed by the child are accompanied by difficulties in motor performance. There has been a limited amount of research done specifically in the area of motor performance of dyslexic children. If the problem of dyslexia is to be fully understood, information is needed concerning the performance of these children in all aspects of human behavior.
Purposes

The primary purpose of this study was to compare performance on selected gross motor skills of elementary school-aged children diagnosed as dyslexic and a similar group of school-aged children who are identified as non-dyslexic.

A secondary purpose of the study will be to compare performance within the dyslexic group according to the severity of the affliction.

Specifically, this study sought to answer the following questions:

1. Is there any difference in the performance of non-dyslexic children and dyslexic children on selected gross motor skills?

2. Is there a difference in performance on selected gross motor skills between subjects who are classified as moderately blocked and those classified as severely blocked in the degree of dyslexia?

Definition of Terms

The following terms and definitions are used in the study:

1. **Dyslexia**—a developmental language disability of central origin with disorders in reading, writing, spelling, and, sometimes, verbal expression (5, p. 11).

2. **Severely blocked**—applies to those dyslexic subjects who, through testing, show difficulty in most or all
of the disorders of reading, writing, spelling, or verbal expression (5, p. 6).

3. Moderately blocked—applies to those dyslexic subjects who, through testing, show difficulty in the area of reading only, or one other language disorder such as writing, spelling, or verbal expression (5, p. 6).
CHAPTER BIBLIOGRAPHY


Although dyslexia has been the subject of much of the recent research done in the area of learning disabilities, most of the studies have dealt with aspects of human behavior other than physical performance. None of the literature reviewed revealed studies which were similar to the present investigation. There have been studies reported that deal with the general relationship between motor performance and reading difficulties as well as learning disabilities. The following review of literature will reflect the results of these investigations.

As a result of a long period of research dealing with reading difficulties and mental retardation, Delecato (5) compiled a list of common traits of children who possessed reading difficulties. Many of the traits were physical or developmental in nature, which led Delecato to suggest that reading problems emanated from the neurological realm.

Irwin (8) stated that trained psychologists also look for physical factors while observing children with reading problems. Among the physical skills evaluated were throwing, catching, rhythm, balance beam walking, and running.
The discovery of the choreiform syndrome by a researcher from the Netherlands offers some new perspectives. Prechtl (11) noticed chorea-like twitchings (slight jerky movements occurring quite irregularly and arrhythmically) in children aged nine to twelve. Concurrently, these children were poor readers and showed a significantly lower performance in their school work. It was found that the eye muscles also moved in "chorea-like" movements. Prechtl also found that these children manifested unrestrained and wild behavior, clumsiness, inability to concentrate, and frequent emotional outbursts. Characteristics such as these were readily observed by the author in professional work with dyslexic children.

Hoyle (7) conducted case studies of five dyslexic boys ranging in age from six to twelve during her experimental physical education program designed for them at St. Christopher's Corrective Learning Center in Lubbock, Texas. The subjects were observed during their participation in the program and daily records were made of their performance. Many desirable changes in adaptability were observed and there were changes in the ability of the boys to learn and perform physical skills. The investigation also concluded that the younger boys in the study seemed to learn a wide range of skills at an earlier stage in the program than did the older boys.

According to Wolfe (15, pp. 67-68), Bryant et al. used the Lincoln Oseretsky Motor Development Scale and compared
the motor behavior of reading disability cases with a sample of normal readers. Both groups were evaluated on the accuracy subtest of the Gilmore Oral Reading Test. In reading, the experimental group was one or more years below grade level, whereas the control group was at grade level or above. The intelligence of all the subjects was average or above, as measured by WISC. The control group was not significantly different from the norms of the Lincoln Scale, whereas the experimental group was significantly below the norms of the Lincoln Scale. The investigators concluded that reading disability cases usually show impairment in their motor development. The impairment was of a more general nature rather than extreme difference in some specific aspect of motor incoordination.

Little research has been reported on educators' efforts to use physical education as an agent in bringing about improvement of reading ability. According to Hoyle (7), one researcher, Godfrey, following two years of studying children with reading disabilities, found that those subjects who participated regularly in her physical education program also improved in their reading performance and in general school achievement.

Bradford (3) studied the effect of a creative dance program on the physical fitness level of mentally retarded children. In order to investigate significant changes in the physical fitness levels of both trainable and educable
retarded students, Bradford administered a battery of physical fitness test items before and after a program of creative dance was conducted for sixty-two mentally retarded girls. Her findings showed significant gains in flexibility, strength, and cardio-vascular endurance for the retarded girls. Important for this investigation are similarities to Bradford's study: (1) the researcher is investigating definite learning disabilities, and (2) the researcher uses the performance of selected standardized physical fitness test items to show changes in levels of physical fitness.

Williams (13) studied the effects of an individualized program of physical education on normal children who possessed reading difficulties. Both specialized programs and individual programs of physical education were administered to children in grades two through five. His evidence showed an apparent independent development of motor skills and reading ability. However, younger children in the lower grades were more affected by individualized physical education programs than older children. Williams suggests that the problem be studied with children beginning at kindergarten age or earlier for possible significant effects.

Money (11) demonstrated with his investigations the difficulty in distinguishing a true dyslexic from a "late bloomer," concluding that no foolproof test has yet been devised. Money reminded educators of the responsibility to educate each pupil to full capacity and advocated provision
of special programs using specially trained teachers in the public schools in hopes of identifying reading difficulties at an early age.
CHAPTER BIBLIOGRAPHY


CHAPTER III
PROCEDURES FOR THE DEVELOPMENT OF THE STUDY

This study compared performance on a battery of gross motor skill tests of elementary school-aged children diagnosed as dyslexic who are receiving daily remedial physical education instruction, with performances made by a sample of similar aged children not identified as dyslexic, also receiving daily instruction in a school physical education program.

Subjects
The experimental group consisted of forty elementary school-aged boys (ages nine through twelve) from Scottish Rite Crippled Children's Hospital Language Laboratory in Dallas, Texas. Each subject of the experimental group had been determined as having a language disability by screening tests administered upon entrance to the Language Laboratory. The subject underwent the following tests to determine if he possessed a language disability in the form of specific dyslexia:

1. Alphabet Oral and Written Recitation in Sequence,
2. Raven's Progressive Matrices (Visual Perception),
3. Beery-Buktenicka Visual-Motor Integration
4. Auditory Discrimination (P.E. Word Test, Wepman, Auditory Recall, and Durrell Listening Comprehension),
5. Peabody Picture Vocabulary (Vocabulary of Recognition),
6. Gilmore Oral Reading,
7. Durrell Oral Reading,
8. Durrell Silent Reading,
9. Gray Oral Reading,
10. Copy Written Paragraph,
11. The American Standard Handwriting Scale,
12. Morrison-McCall Oral and Written Spelling Test,
13. Wide Range Achievement Test (Word Recognition and Arithmetic).

Twenty of the identified dyslexic group possessed a severe degree of blockage in reading; i.e., they manifested writing, spelling, and verbal expression difficulties in addition to reading problems.

The control group consisted of forty elementary school-aged boys (ages nine to thirteen) from North Texas Laboratory School. Each subject had been determined non-dyslexic on the basis of the Stanford-Binet Reading Test administered to each child at the beginning of the school year. Consultation with teachers and school reading test scores were used whenever possible. Subjects in the control group had also participated in the daily physical education program administered by the Laboratory School, involving such activities as
tumbling, rope climbing, trampoline, folk dancing, team sports, and low organized games.

**Dress**

All subjects were tested in street clothes and bare feet with the exception of the softball throw test in which the subjects remained in street shoes.

**Selection of the Tests**

Extensive personal observation and study of dyslexic children prompted the investigator to notice them to be generally inferior in balance and coordination when participating in a structured physical education program or informal play activities.

Consequently, the investigator chose the shuttle run, which judges speed and ability to change direction; the standing broad jump, which measures leg thrusting power; and the softball throw to test arm skill and coordination from the AAHPER Youth Fitness Test Manual. The AAHPER Youth Fitness Test, widely accepted in public schools, offers the advantage of test items designed specifically to represent separate measures of fitness. The items chosen from the manual not only are relatively simple to administer, but the chance of error or variance on the part of the administrator seemed less likely on the items that were selected than on push-ups or pull-ups.
The Nelson Balance Test, a test involving both static and dynamic balance, was selected for its applicability for boys and girls ages ten years through college. The Nelson Balance Test can be administered indoors and requires a minimum of simple equipment.

Complete descriptions of the tests with rules, scoring directions, equipment needed, and illustrations are included in the Appendix.

Administration of the Tests

Schedule for Testing

Dyslexic subjects at Scottish Rite Hospital Language Laboratory were tested twice a week until each subject finished all test items. The subjects were tested in small groups of five to six in order to avoid confusion and facilitate accuracy. Non-dyslexic subjects at North Texas State Laboratory School were tested twice a week until each subject completed all test items. They also were tested in small groups of five to six per group.

To remove possible influence of physical fatigue on any one test item, no more than two items were administered in any one testing day. No subject attempted to accomplish all test items in any one day at either Scottish Rite or North Texas Laboratory School.
Test Order

The investigator administered all tests according to each test's prescribed procedures.

Shuttle run.—The shuttle run was administered on a tile-covered floor in a small gymnasium located in the Language Laboratory at Scottish Rite Crippled Children's Hospital, and on the wooden gymnasium floor at the North Texas Laboratory School. The distance of the shuttle run was clearly marked with masking tape prior to the administration of the test item. The test administrator operated the stop watch and recorded the best of the two trials.

Softball throw.—The softball throw was administered outdoors near the Language Laboratory at Scottish Rite on a flat, grassy surface, and on smooth, level ground or dirt surface near the North Texas Laboratory School gymnasium. The test administrator marked the spot where each ball landed, while delegated student testees retrieved thrown balls. Following the third throw for each subject, the best throw was recorded by the administrator.

Standing broad jump.—The standing broad jump was administered indoors at Scottish Rite and in the North Texas Laboratory School gymnasium on two-inch tumbling mats. A tape measure was taped to the mat with masking tape to mark the distance jumped to the nearest inch. The restraining
line was clearly marked also with a strip of masking tape. The best jump of three attempts constituted the subject's score. The test was measured and recorded by the administrator for each subject being tested.

Nelson Balance Test.—Administration took place inside the North Texas Laboratory School gymnasium and the Scottish Rite Language Laboratory gymnasium. The same nine blocks were arranged in the specified pattern with the same ten-foot balance beam. Each subject was given three trials, and the best trial recorded as the subject's score. The administrator called the five-second intervals when the subject was required to hold his balance on each colored block. The administrator also kept the running score and recorded the best of the three trials.

Analysis of Data

Scores were obtained for all the subjects on four tests of motor performance. The data were analyzed by comparing the dyslexic and non-dyslexic groups on each test through analysis of variance. This same procedure was used also to compare the scores of severely and moderately blocked groups of dyslexic children.
CHAPTER IV

FINDINGS

Four tests involving different aspects of motor performance were administered to forty children diagnosed as being dyslexic and forty children who were non-dyslexic. The means and standard deviations for both groups on all four tests are given in Table I.

**TABLE I**

MEANS AND STANDARD DEVIATIONS FOR DYSLEXIC AND NON-DYSLEXIC GROUPS ON ALL FOUR TESTS

<table>
<thead>
<tr>
<th>Groups</th>
<th>Nelson Balance Mean</th>
<th>S.D.</th>
<th>Softball Throw Mean</th>
<th>S.D.</th>
<th>Shuttle Run Mean</th>
<th>S.D.</th>
<th>Standing Broad Jump Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyslexic</td>
<td>31.97</td>
<td>3.12</td>
<td>1138.95</td>
<td>267.36</td>
<td>11.91</td>
<td>4.26</td>
<td>62.06</td>
<td>7.21</td>
</tr>
<tr>
<td>Non-Dyslexic</td>
<td>29.06</td>
<td>1.91</td>
<td>1187.38</td>
<td>329.58</td>
<td>10.86</td>
<td>0.68</td>
<td>64.21</td>
<td>6.79</td>
</tr>
</tbody>
</table>

*In inches.

**In seconds.

Visual inspection of Table I reveals that on four tests the observed difference between means of the two groups was small, but the variability was also comparable except for the softball throw.

In order to determine whether there was any difference in performance between the two groups, the data for each
test were analyzed by analysis of variance, as shown in Table II.

**TABLE II**

**COMPARISON BY ANALYSIS OF VARIANCE OF THE DYSLEXIC GROUP WITH THE NON-DYSLEXIC GROUP ON THE NELSON BALANCE TEST**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>169.34</td>
<td>1</td>
<td>169.34</td>
<td>24.69</td>
<td>.05</td>
</tr>
<tr>
<td>Within</td>
<td>535.04</td>
<td>78</td>
<td>6.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>704.38</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F ratio needed for significance: .05 level = 3.96.

The comparison of the two groups on the measure of balance resulted in an F ratio of 24.69. Since the F ratio needed at the .05 level was 3.96, the difference between groups in the area of balance is statistically significant.

Table III shows the comparison of two groups on the softball throw resulted in an F ratio of 0.51. Since the

**TABLE III**

**COMPARISON BY ANALYSIS OF VARIANCE OF THE DYSLEXIC GROUP WITH THE NON-DYSLEXIC GROUP ON THE SOFTBALL THROW**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>46891.98</td>
<td>1</td>
<td>46891.98</td>
<td>0.51</td>
<td>NS</td>
</tr>
<tr>
<td>Within</td>
<td>7204067.00</td>
<td>78</td>
<td>92359.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7250959.00</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F ratio needed for significance: .05 level = 3.96.
F ratio required at the .05 level of significance must equal or exceed 3.96, the resulting differences between groups in the softball throw was not significant.

Table IV shows the comparison of two groups on the measure of agility and speed involved in the shuttle run

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>22.15</td>
<td>1</td>
<td>22.15</td>
<td>2.32</td>
<td>NS</td>
</tr>
<tr>
<td>Within</td>
<td>743.54</td>
<td>78</td>
<td>9.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>765.69</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F ratio needed for significance: .05 level = 3.96.

resulted in an F ratio of 2.32. Since this figure does not reach or exceed 3.96, the F ratio required for significance at the .05 level, the differences between groups on shuttle run times were not significant.

Differences on the measure of the standing broad jump are represented by an F ratio of 1.84, as shown in Table V. Since this F ratio does not meet or exceed the 3.96 ratio required for significance at the .05 level, the standing broad jump differences between groups were not significant.

Dyslexic subjects were tested in heterogeneous groups not necessarily following divisions by moderate or severe
TABLE V

COMPARISON BY ANALYSIS OF VARIANCE OF THE DYSLEXIC GROUP WITH THE NON-DYSLEXIC GROUP ON THE STANDING BROAD JUMP

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>92.39</td>
<td>1</td>
<td>92.39</td>
<td>1.84</td>
<td>NS</td>
</tr>
<tr>
<td>Within</td>
<td>3918.09</td>
<td>78</td>
<td>50.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4010.49</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F ratio needed for significance: .05 level = 3.96.

blockage. For purposes of analysis, severity differentiations were made on the basis of information obtained from hospital records.

As shown in Table VI, the differences of times required to perform the balance tasks between groups of moderately blocked dyslexic subjects and severely blocked dyslexic subjects produced an F ratio of 0.02, well below the 4.08

TABLE VI

COMPARISON BY ANALYSIS OF VARIANCE OF THE SEVERE DYSLEXIC GROUP WITH THE MODERATE DYSLEXIC GROUP ON THE NELSON BALANCE TEST

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>0.25</td>
<td>1</td>
<td>0.25</td>
<td>0.02</td>
<td>NS</td>
</tr>
<tr>
<td>Within</td>
<td>389.63</td>
<td>38</td>
<td>10.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>389.88</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F ratio needed for significance: .05 level = 4.08.
An examination of Table VII shows that analysis of the differences between softball throw distances for groups of moderately blocked dyslexics and severely blocked dyslexics produced an F ratio of 0.86. For the appropriate degrees of freedom an F ratio of 4.08 is needed to represent differences significant at the .05 level. Therefore, the group differences are not great enough not to be attributed to chance.

Differences in shuttle run times between groups of severely and moderately blocked dyslexics shows an F ratio of 0.34, as shown in Table VIII. Since this figure did not reach the F ratio of 4.08 needed, this indicates no significant group differences at the .05 level.
TABLE VIII
A COMPARISON BY ANALYSIS OF VARIANCE OF THE SEVERE DYSLEXIC GROUP WITH THE MODERATE DYSLEXIC GROUP ON THE SHUTTLE RUN

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>6.48</td>
<td>1</td>
<td>6.48</td>
<td>0.34</td>
<td>NS</td>
</tr>
<tr>
<td>Within</td>
<td>718.34</td>
<td>38</td>
<td>18.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>724.82</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F ratio needed for significance: .05 level = 4.08.

A close examination of Table IX reveals an F ratio of 4.05 representing differences between groups of severely and moderately blocked dyslexic subjects on the standing broad jump for distance. This figure comes very close to the

TABLE IX
COMPARISON BY ANALYSIS OF VARIANCE OF THE SEVERE DYSLEXIC GROUP WITH THE MODERATE DYSLEXIC GROUP ON THE STANDING BROAD JUMP

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>200.21</td>
<td>1</td>
<td>200.21</td>
<td>4.55</td>
<td>NS</td>
</tr>
<tr>
<td>Within</td>
<td>1876.39</td>
<td>38</td>
<td>49.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2076.59</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F ratio needed for significance: .05 level = 4.08.

F ratio of 4.08 needed for crediting the groups' differences to something more significant than chance. A re-test in a replication study or further investigation of standing broad jump measures for the two groups holds merit.
Since this study was concerned with motor performance of children with a specific type of learning disability as compared with performance of a more normal group of children, the investigator felt that it might be of further interest to examine the performance in terms of the age of the subjects in both groups.

From the tremendous amount of research which has been done, information has been obtained which gives us an idea of what occurs in the normal developmental period of physical growth from birth to adulthood. Because physical performance is directly related to and dependent upon such developmental factors as body size, structure, and function, we have also been able to devise standard expectations of physical performance at various ages.

The subjects in both the dyslexic and non-dyslexic groups were divided into age groups (nine through twelve) and the mean score of each age group on each test was plotted to determine the pattern of performance.

Figure 1 shows the performance by age group on the Nelson Balance Test and a clear distinction is evident between the two groups. The non-dyslexic group indicates a gradual and steady improvement from age nine to age twelve. The dyslexic group, however, shows improvement from age nine to ten, a leveling off between ages ten and eleven, and then a somewhat marked decrease in performance at age
Fig. 1—Mean scores on Nelson Balance Test of four age groups of dyslexic and non-dyslexic subjects.
twelve. Espenshade and Zkurt (1) reviewed several studies done to determine changes in balance over the age range, and, although the results were not completely consistent, the evidence seems to indicate that plateaus can be expected at certain points during this period. None of the studies showed the kind of decrease obtained at age twelve for the dyslexic group, but prior research has shown great variability with any one age group in levels of performance.

Figure 2 reflects the performance by age group on the shuttle run and indicates a comparable pattern between the two groups from age nine through eleven, at which time there was a marked change in the dyslexic group. There have been no previous studies done with the specific ability involved in the test which might help explain the results. Running, which is a part of the ability involved, has been found to progress at a steady increase with age. A possible explanation is that balance does enter into performance on the test and that the pattern exhibited on the shuttle run is a reflection of this influence.

The performance by age group on the standing broad jump is shown in Figure 3. The pattern exhibited by the non-dyslexic group is what could be expected on this kind of test. Jumping ability has been shown to increase steadily with age. The dyslexic group does show an increase with age on this test also, but to a considerably lesser degree. This could very well be attributable to a lack of similar
Fig. 2—Mean Scores on shuttle run for four age groups of dyslexic and non-dyslexic subjects.
Fig. 3—Mean scores on standing broad jump for four age groups of dyslexic and non-dyslexic subjects.
experience in mastering the mechanics of the jump or it could again be a reflection of the balance factor.

Performance on the softball throw, shown in Figure 4, revealed very little difference between the two groups.

It should be noted that this analysis by age group has some limitations due to the small number of subjects in each subgroup. Although there are some implications which can be drawn from the analysis, they should be done with caution.

Investigator's Observations of Subjects' Responses

After presentation of the computations of statistical techniques which are based on the raw numerical data obtained during the study, it would seem appropriate to add some observations of the investigator which cannot be scored in numbers.

Of the four test items, the Nelson Balance Test revealed the clearest differences in motor performance to the investigator. The dyslexic students had much more difficulty doing the motor tasks than non-dyslexic students. Dyslexic subjects manifest many and varied extraneous movements which seem to compound their difficulties.

While the author noticed no appreciable difference in form between dyslexic and non-dyslexic in performance on the softball throw test item, she did notice an important difference on the shuttle run test item. Dyslexic students had
Fig. 4—Mean scores on softball throw for four age groups of dyslexic and non-dyslexic subjects.
much more difficulty with agility and making turns on the shuttle run while seemingly not differing much in linear speed from the non-dyslexic students.

The standing broad jump item revealed that dyslexic students often could not retain their balance after jumping, falling backwards and thereby nullifying their jumps.

Within the dyslexic group, the author could not identify the severely blocked from the moderately blocked students solely on the basis of their motor performance.

Discussion of the Findings

Four motor performance test items were administered to a group of forty dyslexic and non-dyslexic students of similar age. The findings were recorded and evaluated statistically, using the analysis of variance to establish whether differences were significant or not. From the statistical analysis the Nelson Balance Test was the only performance task where the dyslexic group's scores differed significantly at the .05 level of significance. The softball throw, a task of hand-eye coordination and power revealed no significantly different results between the two groups. The shuttle run, a task requiring speed and agility likewise gave no significant differences in performance. The standing broad jump, a task of leg strength and power, and balance revealed differences whereby the dyslexics' jumps were very nearly significantly shorter than those of non-dyslexics.
These facts, coupled with the observations of the investigator indicate a propensity for the dyslexic student to not maintain balance while performing a motor task. It is of some import to this study that the dyslexic's problems with agility during the shuttle run and disqualifications on the standing broad jump are related to the one item which did show to be a significant problem for the dyslexic group—balance. This problem of balance exists in spite of the fact that the special physical education program at the hospital language laboratory school, where the dyslexic subjects were tested, has concentrated activities designed to improve or force the subject to maintain body balance.
CHAPTER BIBLIOGRAPHY

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study was designed to compare performance on selected motor skills of elementary school-aged children diagnosed as dyslexic and a similar group of school-aged children who are identified as non-dyslexic. This study was also designed to compare performance within the dyslexic group according to the severity of the affliction.

Four motor tasks were selected to test motor performance. The shuttle run which judges speed and ability to change direction, the standing broad jump which measures leg strength and thrusting power, the softball throw to test arm skill and coordination, and the Nelson Balance Test to measure static and dynamic balance were the tasks chosen.

Data for determining differences in motor performance were provided by scores from the administration of the above-mentioned tests to two groups of similar aged students. One group of forty students diagnosed as dyslexic were tested at Scottish Rite Crippled Children's Hospital in Dallas, Texas. The other group of forty non-dyslexic subjects were tested at the North Texas State University Laboratory School in Denton, Texas. Further classification of the dyslexic group into moderately and severely blocked groups was possible.
through the courtesy of the hospital's records of other
tests designed for such diagnoses.

Statistical evaluation by analysis of variance of the
data obtained revealed significant differences between
dyslexics and non-dyslexics at the .05 level of significance
in only one test—the Nelson Balance Test for static and
dynamic balance. No significant differences in performance
between severely blocked and moderately blocked dyslexics
were found on any of the other tests.

Based on the results of this study, the following con-
cclusions appear justified:

1. Dyslexic children have more difficulty performing
   motor tasks requiring body balance than non-dyslexic children
   of similar age.

2. Dyslexic children and non-dyslexic children of
   similar age are able to reach comparable distances on soft-
   ball throwing tasks.

3. Dyslexic children and non-dyslexic children of
   similar age perform shuttle run tasks in comparable times.

4. Dyslexic and non-dyslexic children of similar age
   broad jump comparable distances from a standing start.

5. Severely blocked dyslexic children have no more
difficulty performing motor tasks of throwing, running, and
   jumping than moderately blocked dyslexic children.

6. Severely blocked and moderately blocked dyslexic
   children have similar difficulty performing motor tasks
   requiring body balance.
As a result of this study, the following recommendations are presented:

1. Further studies of static and dynamic balance difficulties of dyslexic children should be undertaken.

2. Motor performances of dyslexic and non-dyslexic youths beyond the age of twelve should be investigated.
APPENDIX

THE SHUTTLE RUN FOR BOYS AND GIRLS

Equipment

Two blocks of wood, 2 inches times 2 inches times 4 inches, and a stopwatch. Pupils should wear sneakers or run barefooted.

Description

Two parallel lines are marked on the floor 30 feet apart. The width of a regulation volleyball court serves as a suitable area. Place the blocks of wood behind one of the lines as indicated in the illustration below. The pupil starts from behind the other line. On the signal "Ready? Go!" the pupil runs to the blocks, picks one up, runs back to the starting line, and places the block behind the line; he then runs back and picks up the second block, which he carries back across the starting line. If the scorer has two stopwatches or one with a split-second timer, it is preferable to have two pupils running at the same time. To eliminate the necessity of returning the blocks after each race, start the races alternately, first from behind one line and then from behind the other.

Rules

Allow two trials with some rest between.

Scoring

Record the time of the better of the two trials to the nearest tenth of a second.
THE SOFTBALL THROW FOR DISTANCE FOR BOYS AND GIRLS

Equipment

Softball (12-inch), small metal or wooden stakes, and a tape measure.

Description

A football field marked in conventional fashion (five-yard intervals) makes an ideal area for this test. If this is not available, it is suggested that lines be drawn parallel to the restraining line, five yards apart. The pupil throws the ball while remaining within two parallel lines, six feet apart (see illustration below). Mark the point of landing with one of the small stakes. If his second or third throw is farther, move the stake accordingly so that after three throws, the stake is at the point of the pupil's best throw. It was found expedient to have the pupil jog out to his stake and stand there; and then, after five pupils have completed their throws, the measurements will be taken. By having the pupil at his particular stake, there is little danger of recording the wrong score.

Rules

1. Only an overhand throw may be used.
2. Three throws are allowed.
3. The distance recorded is the distance measured at right angles from the point of landing to the restraining line (see illustration below).

Scoring

Record the best of the three trials to the nearest foot.
STANDING BROAD JUMP FOR BOYS AND GIRLS

Equipment
Mat, floor, or outdoor jumping pit, and a tape measure.

Description
Pupil stands as indicated in illustration below, with the feet several inches apart and the toes just behind the take-off line. Preparatory to jumping, the pupil swings the arms backward and bends the knees. The jump is accomplished by simultaneously extending the knees and swinging forward the arms.

Rules
1. Allow three trials.
2. Measure from the take-off line to the heel or other part of the body that touches the floor nearest the take-off line and have the pupils jump along the tape. The scorer stands to the side and observes the mark to the nearest inch.

Scoring
Record the best of the three trials in feet and inches to the nearest inch.
THE NELSON BALANCE TEST

Objective
To measure both static and dynamic balance in a single test.

Age Level
Ages 10 through college.

Sex
Satisfactory for both boys and girls.

Reliability
Using the average of three trials on a test-retest basis, a coefficient of .89 was obtained.

Validity
The test has face validity as a measure of balance. Moreover, a coefficient of .77 was found when the test was correlated with the combined score of several standard balance measures.

Equipment and Materials
The following equipment and materials are needed:

(1) Nine small wooden blocks, 2" X 4" X 8". A ten foot wooden balance beam, 2" X 4". The beam is held edgewise by three triangular shaped supports (see illustration on page 46).
(2) In order to prevent the blocks from sliding or tipping, pieces of rubber were glued to the bottom of each block. This also protects the gymnasium floor. Four of the blocks are painted red, or in some way marked differently.
(3) Stopwatch, tape measure, and possibly chalk or tape to mark the position of the blocks on the floor.

Directions
Two lines may be drawn 24 inches apart and 20 feet long. The blocks are placed crosswise; the blocks and balance board are positioned as shown in the illustration on page 46.
When ready, the subject steps onto the first block on the ball of the left foot. The tester starts the watch and counts aloud "1-2-3-4-5-" to signify five seconds. (This count is repeated as the subject mounts each red block, but not when he mounts others.)

The performer then proceeds along the route indicated in the illustration on page 46, leaping from one block to the next, alternating feet each time.

The subject tries to go as fast as he can, but without making mistakes. There are four red 5-second-hold blocks where the subject must balance on one foot while the tester calls out the five seconds. When crossing the balance board, the performer must walk heel-to-toe. In other words he cannot cross it by running or in leaps. See diagram on page 46.

Scoring

The score is entirely based on time to the nearest tenth of a second from the start until he steps off the last block.

Penalties

Any time the performer's foot touches the floor, he must get back onto the block at the place at which he fell off and proceed from that point. If the subject should leave one of the "hold" blocks before the five seconds have elapsed, he must return and "hold" for the remaining seconds (i.e., if the subject should leave a red block after 3 seconds, he would have to return and hold for 2 seconds to satisfy the 5 second requirement for the red blocks).

Similarly, if the subject should fall off, or deviate from the heel-to-toe walk across the balance board, he must return to that point at which the fault occurred and resume the walk across the board.

In all cases the watch continues to run until the last "5-second-hold" count at the end of the course.
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