Summer 1971

A Comparison of the Perceptual and Motor Abilities of Learning Disabled and Normal Students at Ages Eleven and Twelve

Rachel Adams Thompson
Old Dominion University

A COMPARISON OF THE PERCEPTUAL AND MOTOR ABILITIES OF LEARNING DISABLED AND NORMAL STUDENTS AT AGES ELEVEN AND TWELVE

A Thesis

Presented to

the Faculty of the Graduate School

Old Dominion University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Rachel Adams Thompson

July 1971

This thesis was prepared by Rachel Adams Thompson under the direction of the chairman of the candidate's supervisory committee, and has been approved by all members of that committee.

Date _____

Supervisory Committee:

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Chairman
Melvin Williams

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THE PROBLEM

During recent years, various theories have been presented in an attempt to explain why some children with normal IQ scores have difficulty in learning to read. The theory by Kephart[1] has received a great deal of attention from both special educators and physical educators: it states that faulty motor development results in inadequate perceptual abilities and consequent failure in school. On the basis of this theory, Kephart suggests perceptual-motor training programs for children with learning problems. In many elementary schools similar programs have replaced the traditional physical education programs.

If Kephart's theory is a sound one, then children with learning problems should evidence a greater number of perceptual and motor problems than normal achievers. A number of studies dealing with these areas of functioning and their relationships to learning problems have evaluated children in kindergarten or the first

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[1]Newell C. Kephart, The Slow Learner in the Classroom (Columbus, Ohio: Charles E. Merrill Books, Inc., 1960).

two grades of school. Many have shown that children who have immature perceptual and motor processes at the beginning of the first grade are below average achievers at the end of the first year of school: the poor achievers show a greater number of perceptual and motor problems than do the normal achievers in most of the studies. Those done by Dudek, et al.,[2] Thweatt,[3] and Koppitz, et al.,[4] are typical of the work which has been done.

Other investigators, such as Williams,[5] O'Connor,[6] and Keim,[7] have attempted to assess the

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[2]S. Z. Dudek, J. S. Goldberg, E. P. Lester, and B. R. Harris, "The Validity of Cognitive, Perceptual-Motor and Personality Variables for Prediction of Achievement in Grades I and II," Journal of Clinical Psychology, 23:461-464, October, 1967.

[3]Roger C. Thweatt, "Prediction of School Learning Disabilities Through the Use of the Bender Gestalt Test: A Validation Study of Koppitz's Scoring Technique," Journal of Clinical Psychology, 19:216-217, April, 1963.

[4]Elizabeth M. Koppitz, Verdena Mardis, and Thomas Stephens, "A Note on Screening School Beginners with the Bender Gestalt Test," Journal of Educational Psychology, 52:80-81, April, 1961.

[5]Sebron Belton Williams, "The Effects of Individualized Programs of Physical Education on Normal Children Who Have Reading Difficulties," Dissertation Abstracts, 29:1693-A, December, 1968.

[6]Colleen O'Connor, "Effects of Selected Physical Activities Upon Motor Performance, Perceptual Performance, and Academic Achievement of First Graders," Perceptual and Motor Skills, 29:703-709, December, 1969.

[7]Richard P. Keim, "Visual-Motor Training, Readiness, and Intelligence of Kindergarten Children," Journal of Learning Disabilities, 3:256-259, May, 1970.

effects of visual-perceptual or perceptual-motor programs on various measures of academic achievement. On the basis of these studies, one can only conclude that the effects of perceptual-motor programs on achievement are questionable. On the other hand, there is an indication that low achievers in the early school grades could benefit from the perceptual-motor programs because the programs do improve perceptual and motor development. Haring and Stables,[8] for example, found that special training in gross motor coordination and visual perception positively affected a child's development in visual perception and eye-hand coordination.

Fewer studies have been done to compare the perceptual and motor abilities of normal and learning disabled students, and those which have been done reveal contradictory results. Van de Riet and Van de Riet[9] concluded from their study that children with learning disabilities were probably not held back because of poor visual-motor coordination. On the other hand,

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[8]Norris G. Haring and Jeanne Marie Stables, "Visual Perception and Eye-Hand Co-ordination," Physical Therapy, 46:129-135, February, 1966.

[9]Vernon Van de Riet and Hani Van de Riet, "Visual-Motor Co-ordination in Underachieving and 'Normal' School Boys," Perceptual and Motor Skills, 19:731-734, December, 1964.

Weathers[10] found that good readers performed significantly better than poor readers on eye-motor coordination tests. Studies dealing with younger students reveal significant differences in perceptual-motor abilities more frequently than those dealing with children age ten or older. Because of varying rates of maturation, children who were below average in perceptual and motor abilities at the first grade level may perform normally by the time they reach the upper elementary grades. Academically, however, they may continue to perform below average because of their initial poor achievement. Albright[11] compared a group of ten year old retarded readers and a group of ten year old normal students on five tests of perception. She found no difference in function between the two groups. She stated, however, that the retarded readers may have had perceptual difficulties when they were younger, but compensated for them in the course of maturation.

Students who exhibit normal functioning in the areas of perception and motor ability, whether they be academically retarded or not, would not need special

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[10]Lillian Louise Weathers, "A Comparison of Visual-Perceptual Development and Reading Achievement of Fifth Grade Adequate and Inadequate Readers," Dissertation Abstracts, 27:2756-A, March, 1967.

[11]Mary Joan Albright, "Visual Perception in Children of Retarded and Normal Reading Ability," Dissertation Abstracts, 27:2128-B, December, 1966.

perceptual-motor training programs. Should older students with learning disabilities also perform below average in perceptual and motor areas, however, one could suspect a problem more serious than slow maturation and would be justified in including a remedial perceptual-motor program for the older learning disabled student.

There are several problems involved in evaluating the perceptual-motor processes of older children. First, many of the tests which purport to evaluate the functioning of children in perceptual and motor areas are desigend to evaluate children who are ten years old or younger, for after that age, the perceptual-motor processes should be mature and few if any errors would be made on the tests. In the case of children with perceptual-motor deficits, however, the tests could still be used.[12]

There is also the question of validity, for it is difficult to determine what perceptual and motor processes the tests measure. In the area of visual perception, copying tests have been widely used, but the forms to be copied vary greatly from test to test. In the evaluation of gross perceptual-motor abilities, test items vary also, and research has shown that performance on one test of perceptual-motor ability is

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[12]Elizabeth M. Koppitz, The Bender Gestalt Test for Young Children (New York: Grune and Stratton, Inc., 1964), p. 60.

seldom related to performance on another test. Even performance on test items designed to measure the exact same abilities show little if any correlation.[13]

Three tests which have been used to evaluate perceptual and motor processes are the Bender Gestalt Test, the Purdue Perceptual Motor Survey, and Cratty's Six Category Gross Motor Test. The Bender Gestalt Test[14] is a test of visual-perception which involves the copying of nine forms. The "Koppitz Developmental Bender Scoring System for Young Children"[15] was devised to determine the level of perceptual maturity in children ten years old or younger. By the age of eleven, few errors should be made; poor performance by older children would indicate serious visual perceptual problems.

The Purdue Perceptual Motor Survey[16] is an instrument designed to assess the perceptual-motor abilities of children. It combines visual-perceptual items, such as copying items similar to those on the Bender, and gross perceptual-motor items. All items

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[13]Norris G. Haring and Robert W. Ridgway, "Early Identification of Children with Learning Disabilities," Exceptional Children, 33:387-395, February, 1967.

[14]Lauretta Bender, A Visual Motor Gestalt Test and Its Clinical Use, American Orthopsychiatric Association Research Monographs, No.3 (New York: American Orthopsychiatric Association, 1938).

[15]Koppitz, op. cit., pp. 15-70.

[16]Eugene G. Roach and Newell C. Kephart, The Purdue Perceptual-Motor Survey (Columbus, Ohio: Charles E. Merrill Books, Inc., 1966).

were chosen because of their supposed relationship to academic achievement. Norms have been established for six to ten year olds, for the authors feel that some of the items are too simple for older children. Poor performance by older children would suggest serious problems in perceptual-motor development.

The Six Category Gross Motor Test by Cratty[17] is similar to the Purdue Perceptual Motor Survey in that it includes gross motor skills which rely heavily on perception. None of the test items are identical, however. Cratty's test does not include fine visual-perceptual items, and the test items were chosen because of their relation to ability to "succeed on the playground", rather than to academic skills. The test is to identify students who Cratty feels would benefit from fundamental perceptual-motor training. Norms have been established for ages four through eleven.

STATEMENT OF THE PROBLEM

The problem undertaken in this study was to determine if there were any significant differences in the perceptual and motor abilities of a group of learning disabled students and a group of normal students at ages eleven and twelve. A subproblem was to determine

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[17]Bryant J. Cratty and Sister Margaret Mary Martin, Perceptual-Motor Efficiency in Children (Philadelphia: Lea and Febiger, 1969).

what relationship existed among the various perceptual and motor abilities being measured.

PURPOSE OF THE STUDY

The purpose of this study was to test two selected groups of subjects on the Bender Gestalt Test, the Six Category Gross Motor Test, and the Purdue Perceptual Motor Survey. More specifically, the purpose was to determine if performance by one group was significantly better than that of the other group. A secondary purpose of the study was to determine to what extent the three tests were related.

HYPOTHESES

The null hypotheses were tested:

1. There would be no difference between the performances of the two groups on any of the tests.

2. There would be no relationship between any of the tests.

SIGNIFICANCE OF THE STUDY

A study comparing the performance of a group of learning disabled students and a group of normal students, ages eleven and twelve, would be of value for it would provide information concerning the characteristics of learning disabled students at a particular age.

This information would have implications for the educational programs to be provided for the learning disabled. If the learning disabled group evidenced inferior perceptual-motor development, then a remedial perceptual-motor program would be indicated. If, however, perceptual-motor development did not differ from that of the normal group, one might conclude that no specialized physical education program would be needed.

A correlational analysis of the three tests would be of value for it would indicate the relationship of visual-perception, perceptual-motor abilities, and gross motor abilities. It would also suggest to what extent tests purporting to measure the same abilities actually do so.

SCOPE

The learning disabled group was composed of fifteen subjects randomly selected from among students enrolled in the Academic II and III classes at the Diagnostic Special Education School of Tidewater Rehabilitation Institute in Norfolk, Virginia. All were ages eleven or twelve and had average or above average Intelligence Quota scores. They had been referred to the school on the basis of failure to achieve in a public school. No students with observable physical defects or severe emotional disturbances

were included.

The normal group was composed of students randomly selected from among sixth graders at Alvin Elementary School in Alvin, Texas who had similar ages and IQ scores as the learning disabled group. All were considered to be achieving normally by their teachers and none had any observable physical impairment or severe emotional involvement.

GENERAL PROCEDURE

All testing was done on an individual basis by the investigator in the Motility Room at Tidewater Rehabilitation Institute and the Apparatus Room at Alvin Elementary School. Each subject was involved in two testing periods. During the first one, the Bender Gestalt Test and the Six Category Gross Motor Test were administered; on another day the Purdue Perceptual Motor Survey was administered. All testing procedures, equipment used, and scoring techniques were in accordance with specifications in the test manuals.

ASSUMPTIONS

The following assumptions were made:

1. Previous exposure to any of the tests would not affect one's performance on that test.

2. Geographic differences would not affect abilities being measured by the tests.

LIMITATIONS

The following limitations to the study were identified:

1. Due to the amount of time involved in administering the tests, the investigator was unable to test each subject at the same time of day.

2. Although an effort was made to avoid testing subjects at a time when they were emotionally upset, no real control could be made for emotional responses.

DEFINITION OF TERMS

The following definitions were accepted for terms used in the study:

1. Learning disability - a condition characterized by an educationally significant discrepancy between estimated potential for learning and day to day level of functioning. It is not secondary to generalized mental retardation, severe emotional disturbance, extreme environmental or educational deprivation, blindness or deafness.[18]

2. Visual perception - "...that process by which phenomena are apprehended by the mind through

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[18]Norris G. Haring and Robert W. Ridgway, "Early Identification of Children with Learning Disabilities," Exceptional Children, 33:387-395, February, 1967.

the medium of the eye..."[19]

3. Visual (perceptual) motor functioning - the process involving visual perception and the expression of it; the result reflects the quality of perception plus the motor impulsivity and attempts at its control.[20]

4. Bender Gestalt Test - a visual motor test devised by Bender consisting of nine figures to be copied. The perception and reproduction of the figures depend on the growth pattern and maturation level of an individual and his pathological state, whether it be functionally or organically induced.[21]

5. The Developmental Bender Scoring System for Young Children - a scoring system for the Bender Gestalt Test devised by Koppitz to be used in identifying immaturity or perceptual malfunctioning in young children. Thirty items are scored as either absent or present in the child's drawings.[22]

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[19]Jean Turner Goins, Visual Perceptual Abilities and Early Reading Progress (Chicago: University of Chicago Press, 1958), p.1.

[20]Frank M. Lachmann, "Perceptual-Motor Development in Children Retarded in Reading Ability," Journal of Consulting Psychology, 24:427-431, October, 1960.

[21]Lauretta Bender, A Visual Motor Gestalt Test and Its Clinical Use, American Orthopsychiatric Association Research Monographs, No.3 (New York: American Orthopsychiatric Associations, 1938).

[22]Elizabeth M. Koppitz, The Bender Gestalt Test for Young Children (New York: Grune and Stratton, Inc., 1964).

6. The Purdue Perceptual Motor Survey - "...a tool which can be used to identify those children who do not possess perceptual-motor abilities necessary for acquiring academic skills by the usual instructional methods."[23] The Survey consists of five major sections and eleven activities. The sections include:

a. Balance and posture - positive neuromuscular acts in which muscle groups are innervated in patterns so that the position of the body is maintained with reference to its center of gravity.

b. Body image and differentiation - the knowledge of the pattern of one's body: its movements, its parts, and its positions in space.

c. Perceptual-motor match - an integration of perceptual information and motor information through the manipulation of objects.

d. Ocular control - control of the muscles used in focusing the eyes.

e. Form perception - the identification of the various elements in a perceptual impression and the organization and integration of those elements into a figure or form.

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[23]Eugene G. Roach and Newell C. Kephart, The Purdue Perceptual-Motor Survey (Columbus, Ohio: Charles E. Merrill Books, Inc., 1966), p.iii.

7. Six Category Gross Motor Test - a test battery designed by Cratty to identify children with mild to moderate perceptual-motor problems. It evaluates body perception, gross agility, balance, locomotor agility, throwing skills, and ball tracking skill at two levels.[24]

a. Gross agility - the ability to move the body in a coordinated manner while remaining in a relatively fixed location.

b. Locomotor agility - the ability to move the whole body some distance accurately and efficiently.

c. Throwing skill - the ability to accurately and effectively propel a ball through the air with the hands.

d. Ball tracking skill - the ability to anticipate and react to a moving ball.

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[24]Bryant J. Cratty, Perceptual-Motor Behavior and the Educational Processes (Springfield, Illinois: Charles C. Thomas, 1969).

Chapter 2

REVIEW OF THE LITERATURE

Studies which are pertinent to the present study fall into several categories. These include those that have investigated the use of perceptual-motor abilities for predicting academic achievement, determined the effectiveness of perceptual-motor programs in improving academic achievement, compared the perceptual-motor abilities of normal and learning disabled students, and studied the relationship of perceptual-motor abilities and academic achievement.

PREDICTION OF ACADEMIC ACHIEVEMENT

The Bender Gestalt Test has been used in several studies to determine if first grade visual-motor performance can be used to predict future academic achievement. In a longitudinal study, Keogh and Smith[1] administered the Bender Gestalt Test and standard achievement tests to a group of children at the kindergarten level, when they were in the third grade, and again

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[1]Barbara K. Keogh and Carol E. Smith, "Visuo-Motor Ability for School Prediction: A Seven Year Study," Perceptual and Motor Skills, 25:101-110, August, 1967.

at the sixth grade level. They found that the Bender could be used to predict academic performamce, with the kindergarten Bender being more highly related to sixth grade reading than either the third or sixth grade Bender. The initial Bender Gestalt Test was 82 percent accurate in predicting sixth grade reading achievement, 74 percent accurate in predicting spelling, and 71 percent in predicting arithmetic.

Thweatt[2] administered the Bender Gestalt Test to each of his subjects during the first month of their first year in school. After two years he administered the Durrell Analysis of Reading Difficulty to the same subjects. A correlation coefficient of .67 was obtained for the Bender and the vocabulary subtest, and .76 for the Bender and the comprehension subtest. Approximately 77 percent of the students scoring above the mean on the Bender Gestalt Test were reading problem cases by the middle of the third grade. The author concluded that the Bender Gestalt Test can predict future reading problems with accuracy.

The predictive ability of the Bender was also

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[2]Roger C. Thweatt, "Prediction of School Learning Disabilities Through the Use of the Bender Gestalt Test: A Validation Study of Koppitz's Scoring Techniques," Journal of Clinical Psychology, 19:216-217, April, 1963.

investigated by Koppitz, Mardis, and Stephens.[3] They gave the Lee-Clark Reading Readiness Test, the Metropolitan Readiness Test, and the Bender Gestalt Test to two hundred seventy-two beginning first grade students. At the end of the year, they administered achievement tests to the subjects. The Bender was found to correlate highly with the readiness tests and to predict actual achievement with the same degree of accuracy.

A study by Keogh[4] reveals slightly different results. She gave the Bender to a group of kindergarten students. When they reached the third grade, she readministered the Bender and gave the California Test of Mental Maturity and three subtests of the California Reading Test. She also gathered teacher ratings of the subjects' scholastic performance. She found that only good performance on the Bender Gestalt Test was predictive of reading achievement; a poor Bender was nondefinitive. She concluded that the test was of limited use for the prediction of reading

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[3]Elizabeth M. Koppitz, Verdena Mardis, and Thomas Stephens, "A Note on Screening School Beginners with the Bender Gestalt Test," Journal of Educational Psychology, 52:80-81, April, 1961.

[4]Barbara K. Keogh, "The Bender Gestalt Test as a Predictive and Diagnostic Test of Reading Performance," Journal of Consulting Psychology, 29:83-84, February, 1965.

disability in the primary grades. It could be used as an early screening device for the identification of children likely to be successful in school.

Conner[5] found a significant positive relationship between total scores on the Bender Gestalt Test and reading performance. However, as many normal readers scored above the mean of 4.2 (higher scores reflect poorer performances) as did poor readers. Conner concluded, therefore, that regardless of the significant relationship found between reading achievement and Bender performance, the Bender Gestalt Test cannot be considered as a highly valid instrument for predicting reading abilities of second grade children with average intelligence.

Lessler, Schoeninger, and Bridges[6] investigated the relative effectiveness of the Lee-Clark Reading Readiness Test, the Peabody Picture Vocabulary Test, and the Bender Gestalt Test in predicting reading test scores. The three predictive measures were administered to beginning first grade subjects and compared to scores

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[5]James Paul Conner, "The Relationship of Bender Visual-Motor Gestalt Test Performance to Differential Reading Performance of Second Grade Children," Dissertation Abstracts, 28:491-A, August, 1967.

[6]Ken Lessler, D. W. Schoeninger, and Judith S. Bridges, "Prediction of First Grade Performance," Perceptual and Motor Skills, 31:751-756, December, 1970.

made on reading tests given at the end of the first grade. The Lee-Clark test was found to be the best single predictor of reading test scores, and the other two measures added little to its predictive ability.

The Bender Gestalt Test was found to be of little predictive value by Giebink and Birch.[7] They found a correlation coefficient of -.19 for kindergarten performance on the Bender and second grace reading achievement, and -.17 for first grade Bender performance and second grade reading achievement.

A battery of tests, including the Bender Gestalt Test, was used by Egeland, di Nello, and Carr[8] to determine the best combination of scores for predicting achievement of first and third grade boys. Tests of intelligence, psycholinguistic abilities, reading readiness skills, and visual-motor skills were given to eighty-two boys at the beginning of the first grade. Results indicate that valid predictions of first and third grade achievement can be made by evaluating a child's perceptual-motor, intellectual, and linguistic

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[7]John W. Giebink and Robert Birch, "The Bender Gestalt Test as an Ineffective Predictor of Reading Achievement," Journal of Clinical Psychology, 26:484-485, October, 1970.

[8]Byron Egeland, Mario di Nello, and Donald Carr, "The Relationship of Intelligence, Visual-Motor, Psycholinguistic, and Reading Readiness Skills with Achievement," Educational and Psychological Measurement, 30:451-458, Summer, 1970.

abilities in the first grade. Correlations of the perceptual-motor measures and achievement, however, were generally low.

Dudek, Goldberg, Lester, and Harris[9] also used a battery of tests to determine which were of most value in predicting school performance. The Weschler Intelligence Scale, the Lincoln-Oseretsky Motor Development Scale, the Goodenough Draw-a-Man Test, and the Rutgers Drawing Test were administered to one hundred and three students at the kindergarten level and at the first grade level. All subjects had IQ scores of 80 or above. Results showed that each of the intelligence and perceptual-motor tests and most of the WISC subtests could validly predict achievement scores at the end of grades I and II. The Lincoln-Oseretsky Motor Development Scale administered at the kindergarten level correlated .50 and .43 with first and second grade achievement, respectively. The first grade Motor Development scale correlated .48 with second grade achievement.

In summary, the Bender Gestalt Test was used in all but one of the studies to determine if visual-motor performance could be used to predict academic achievement. Results of three studies indicated that the

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[9]S. Z. Dudek, J. S. Goldberg, E. P. Lester, and B. R. Harris, "The Validity of Cognitive, Perceptual-Motor, and Personality Variables for Prediction of Achievement in Grades I and II," Journal of Clinical Psychology, 23:461-464, October, 1967.

Bender did accurately predict achievement, while three studies resulted in the opposite conclusion. One researcher found that only good Bender performance was predictive of reading achievement, and another suggested that a combination of perceptual-motor, intelligence, and linguistic tests provided the most successful instrument for predicting success in school. Only one study investigated the predictive value of gross motor tests; the Lincoln-Oseretsky Developmental Motor Scale was found to be of value in predicting academic achievement.

EFFECTIVENESS OF PERCEPTUAL-MOTOR PROGRAMS IN IMPROVING ACADEMIC ACHIEVEMENT

A great many studies have been done recently to evaluate the effectiveness of perceptual-motor training programs in improving perceptual-motor skills, academic readiness, and academic achievement. Results of the studies have been contradictory, and the value of the programs is questionable.

Rutherford[10] instructed a group of normal kindergarten children in a perceptual-motor program similar to those suggested by Kephart. A control group engaged in regular play for the same period of time: thirty minutes a day for eleven weeks. Pre- and post-tests were given to both groups to measure reading,

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[10]William Lewis Rutherford, "The Effects of a Perceptual-Motor Training Program on the Performance of Kindergarten Pupils on the Metropolitan Readiness Tests," Dissertation Abstracts, 25:4583, February, 1965.

number, and total readiness before and after the experimental period. The experimental group made significantly greater gains in readiness for academics than did the control group, and the author concluded that perceptual-motor training programs are highly effective in promoting total readiness for school.

A Kephart-type program was also used in a study by Painter.[11] She chose the twenty lowest functioning students in a kindergarten class and divided them into an experimental and a control group. The experimental group was given a systematic rhythmic and sensory-motor activity program while the control group received no special training. Results of the study supported all of the hypotheses being tested:

1. The program would affect level of ability to draw a human figure.

2. The program would ameliorate apparent distortions of the body image concept.

3. The program would improve sensory-motor spatial performance skills.

4. The program would improve psycholinguistic abilities.

Lazroe[12] used children from sixteen kindergarten

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[11]Genevieve Painter, "The Effect of a Rhythmic and Sensory-Motor Activity Program on Perceptual-Motor Spatial Abilities of Kindergarten Children," Exceptional Children, 33:113-116, October, 1966.

[12]James Joseph Lazroe, "An Investigation of the Effects of Motor Training on the Reading Readiness of Kindergarten Children," Dissertation Abstracts, 29:2609-A,

classes in his study. Eight classes, the experimental group, received a program of gross motor activities one-half hour daily for eight weeks. The other eight classes, the control group, received no special training. Both groups were given pre- and post-tests on the Metropolitan Readiness Tests and the Perceptual Forms Tests as measures of readiness for reading. Results of the study led the investigator to conclude that a systematic program of gross motor activities in the curriculum of kindergarten children significantly improved their readiness for reading.

Haring and Stables[13] dealt with a group of educable mentally retarded children in seeking to determine the effect of gross motor training on visual perception and eye-hand coordination. The experimental group was rated on the Purdue Perceptual Motor Survey and then given work in the areas where they showed the greatest deficiencies. For seven months they received the special training in gross motor coordination and visual perception, while the control group was given no special training. Pre-, post-, and follow-up tests of visual perception and eye-hand coordination were administered to both groups. The experimental group

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[13]Norris G. Haring and Jeanne Marie Stables, "Visual Perception and Eye-Hand Coordination," Physical Therapy, 46:129-135, February, 1966.

showed significantly more improvement than the control group on the post-test and the follow-up test. Haring and Stables concluded that gross motor training can be successfully used to develop fine motor abilities which have a direct effect on learning capabilities.

In a study to assess the relative effectiveness of remedial reading instruction with and without perceptual-motor training, Wharry[14] dealt with thirty boys, ages nine through twelve. She divided them into two groups, experimental and control. Both groups received remedial reading instruction, and the experimental group also received perceptual-motor training. The subjects were given pre- and post-tests on the Screening Test for Children with Specific Language Disabilities, the Metropolitan Achievement Test, and the Purdue Perceptual Motor Survey. The experimental group improved significantly greater than the control group on eighteen of the thirty-three variables tested; however, the results are questionable because the experimental group received training directly related to many of the test items.

Lipton[15] concducted a program in perceptual-motor

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[14]Rhoda Elizabeth Wharry, "Perceptual-Motor Generalizations and Remedial Reading," Dissertation Abstracts, 30:1930-A, November, 1969.

[15]David Edward Lipton, "The Effect of a Physical Education Program to Develop Directionality of Movement on Perceptual-Motor Development, Visual Perception, and Reading Readiness of First Grade Children," Dissertation Abstracts, 30:2362-A, December, 1969.

development which emphasized directionality of movement. He administered it to an experimental group of forty-six first graders twice a week for twelve weeks. A control group, equated on age, weight, and height with the experimental subjects, participated in conventional physical education activities during the same period. Both groups were evaluated in perceptual-motor development, visual perception, and reading readiness before and after the experimental program. The group receiving the specialized perceptual-motor training significantly improved in contrast to the control group. However, the correlation between change in perceptual-motor abilities and change in reading readiness was as low for the experimental group as for the control group.

McCormick, Schnobrich, Footlick, and Poetker[16] assigned forty-two first graders to one of three groups: experimental, which received perceptual-motor training; control A, which received standard physical education training; and control B, which received no training. The experimental group showed statistically significant gains in reading achievement, while the two control groups did not. One should point out, however, that

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[16]Clarence C. McCormick, Janice Nelson Schnobrich, S. Willard Footlick, and Betty Poetker, "Improvement in Reading Achievement Through Perceptual-Motor Training," Research Quarterly, 39:627-633, October, 1968.

the training period was extremely brief. It consisted of two forty-five minute sessions per week for seven weeks. The investigators suggest that improvement in reading by the experimental group could have been due to imcreased self-control, better attention, and longer concentration span rather than actual changes in more subtle intellectual abilities.

The effects of a Frostig training program on academic readiness and visual-motor abilities were studied by Malehorn.[17] The program consisted of large and fine motor activities and ocular pursuit training, and it was given to a group of kindergarten students fifteen minutes a day for twenty-four weeks. A control group engaged in expanded reading readiness and general physical education activities for the same period of time. All subjects were tested at the end of the program on the Metropolitan Readiness Test, the Evanston Early Identification Scale, the Short Test of Educational Ability, the Frostig Developmental Test of Visual Perception, the Beery-Buktenica Test, and the Bender Gestalt Test. On all tests but the Beery-Buktenica and the Bender Gestalt, the two tests of visual-perception in the battery, the experimental group performed

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[17]Harold Arthur Malehorn, "Some Effects of Specific Visual-Motor Training on the Perceptual Development of Kindergarten Children," Dissertation Abstracts, 31:3173-A, January, 1971.

significantly better than the control group. Malehorn suggests that perceptual-motor training programs would more likely benefit children with learning disabilities due to perceptual difficulties than the general kindergarten population.

The directors of the Children's Physical Developmental Clinic at the University of Maryland have conducted studies to assess the effects of their program on perceptual-motor abilities. Johnson and Fretz[18] tested changes in perceptual skills using tachistoscopic presentations of one to four digits at increasingly shorter speeds. Changes in motor skills were tested with mirror drawings scored for time, distance, and quality. The subjects, ages four to seventeen, performed significantly better at the end of the training program on both the tachistoscope test and the mirror drawing test. The investigators concluded that the clinic does improve perceptual-motor skills.

Another study by Fretz, Johnson, and Johnson[19] reveals somewhat different results. Fifty-three boys, ages five to eleven, who were enrolled in the clinic were tested one week before and one week after the eight

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[18]Warren R. Johnson and Bruce R. Fretz, "Changes in Perceptual-Motor Skills After a Children's Physical Developmental Program," Perceptual and Motor Skills, 24:610, April, 1967.

[19]Bruce R. Fretz, Warren R. Johnson, and Julia A. Johnson, "Intellectual and Perceptual-Motor Development as a Function of Therapeutic Play," Research Quarterly, 40:687-691, December, 1969.

week clinic. Another group not yet enrolled was tested ten weeks before the clinic began and again immediately before the opening of the clinic. Tests used were the Frostig Developmental Test of Visual Perception, the Wechsler Intelligence Scale for Children, the Bender Gestalt Test, and the Southern California Kinesthesia and Tactile Perception Tests. On the Frostig test and the Bender Gestalt, the experimental group made significant improvement on every subtest; the control group made no improvement and even regressed significantly on the Figure Ground subtest of the Frostig and on the Bender Gestalt Test. The experimental group increased on the Performance IQ of the WISC; the control group progressed on the Verbal IQ. Neither group progressed significantly on the Kinesthesia and Tactile Perception Tests. Directors of the clinic concluded from this study that their program contributed to development of generalized motor performance, but that results from perceptual and intellectual tests are less conclusive.

Williams[20] hypothesized that individualized physical training would result in greater mean gains in reading achievement than either group physical edu-

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[20]Sebron Belton Williams, "The Effects of Individualized Programs of Physical Education on Normal Children Who Have Reading Difficulties," Dissertation Abstracts, 29:1693-A, December, 1968.

cation or sedentary activities. He also hypothesized that gains in physical fitness would be related to gains in reading. From his study he found that the individualized physical education program did lead to greater gains in physical fitness than either group physical education or sedentary activities. There appeared to be no relationship, however, between physical fitness gains and improvement in reading abilities.

O'Connor[21] also found that an experimental perceptual-motor program positively affected motor skills but not perceptual or academic abilities. She randomly assigned one hundred twenty-three first graders to an experimental group or a control group. The experimental group engaged in Kephart's suggested activities while the control group participated in a traditional physical education program. Pre- and post-tests were given on grip strength, back and leg lift strength, the Sargent jump, the standing broad jump, the squat thrust, the side-step, the thirty yard dash, the twenty-five foot run-and-sit test, the fifty foot hopping test, and the ball bounce test. Tests of lateral awareness, the Perceptual Forms Test, and the Metropolitan Readiness and Achievement Tests were also given. The experimental group showed significantly greater gains on all motor

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[21]Colleen O'Connor, "Effects of Selected Physical Activities Upon Motor Performance, Perceptual Performance, and Academic Achievement of First Graders," Perceptual and Motor Skills, 29:703-709, December, 1969.

tests except on the grip strength test. Many of the motor skills were actually practiced by the experimental group, however. There was no difference in gains made by the two groups on any of the lateral awareness, perceptual forms, or readiness and achievement tests.

Results of Fisher's[22] study indicate that a special perceptual-motor program is no more effective than a traditional physical education program in increasing motor abilities or academic abilities. A group of kindergarten students participated in a sequential, individualized program of perceptual-motor activities twenty minutes a day for twenty-two weeks. The control group engaged in traditional physical education activities. There was no significant difference in improvement of intelligence scores, readiness scores, or motor ability scores, and no significant relationship was found to exist between motor ability and intelligence or academic readiness.

McRaney[23] also found that a perceptual-motor program was no more beneficial in improving academic

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[22]David H. Fisher, "The Effects of Two Different Types of Physical Education Programs Upon Skills Development and Academic Readiness of Kindergarten Children," Dissertation Abstracts, 31:1600-A, October, 1970.

[23]Kenneth Allen McRaney, "A Study of Perceptual-Motor Exercises Utilized as an Early Grade Enrichment Program for the Improvement of Learning Activity and Motor Development," Dissertation Abstracts, 31:3935-A, February, 1970.

abilities or perceptual-motor functioning than more traditional physical education programs. He assigned twenty-seven first graders to each of the four treatment groups: three experimental groups (perceptual-motor enrichment, regular physical education, and adaptive physical education) and one control group (free play). The programs were administered thirty-five minutes daily for twenty weeks. The Metropolitan Readiness and Achievement Tests, the Primary Mental Abilities Test, and the Purdue Perceptual Motor Survey were given to all subjects before and after the experimental program. The perceptual-motor training resulted in no more improvement in perceptual-motor ability, mental ability, academic readiness or achievement than any other forms of physical activity. In addition, perceptual-motor ability was shown to be unrelated to mental ability and academic readiness and achievement.

Keim[24] investigated the effects of a visual-perceptual training program. He used the Bender Gestalt Test as a criterion measure for identifying kindergarten children with poor visual-motor skills. Those identified were assigned to the experimental group, which received the visual-perceptual training, or to the control group which received only the regular kindergarten

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[24]Richard P. Keim, "Visual-Motor Training, Readiness, and Intelligence of Kindergarten Children," Journal of Learning Disabilities, 3:256-259, May, 1970.

program. The Bender was readministered at the end of the training program, along with the Metropolitan Readiness Test and the Peabody Picture Vocabulary Test. A significant difference was found between the groups on the matching and copying subtests of the achievement test, but no significant difference was found on the IQ test. Forty percent of the experimental subjects and 57.1 percent of the control subjects continued to have poor visual-motor skills. These findings indicate that the visual-motor training program was of little value in increasing readiness for learning or intelligence and that it did not completely eliminate visual-motor deficiencies.

Arciszewski[25] reported similar results. He hypothesized that subjects receiving visual-perceptual training would attain significantly higher scores on tests of visual-perception and reading achievement than those receiving supplemental phonics training or basal reader training. After twenty-two weeks, subjects in the visual-perceptual training group showed no more improvement in visual-perception or reading achievement than the phonics training group or the basal reader

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[25]Raymond Arthur Arciszewski, "The Effects of Visual Perceptual Training on the Perceptual Ability and Reading Achievement of First Grade Students," Dissertation Abstracts, 29:4174-A, June, 1969.

training group.

Falik[26] also tested the effectiveness of a perceptual-motor training program. He identified the kindergarten students performing in the lower two-thirds of their class on the Anton Brenner Developmental Gestalt Test and assigned them to the experimental or the control group. The perceptual-motor training was continued until the subjects reached the middle of second grade. At that time they were given perceptual and academic achievement tests. No significant difference in achievement or visual-perception was found to exist between students who had received the special program and those who had not.

An experimental group in Bennett's[27] study received training in visual-perception for eighty school days. At the end of that period, they performed significantly better than the control group on a Perceptual Forms Test. There was, however, no difference between groups in academic achievement at the end of the program. Bennett concluded that such a program may be of benefit to children with perceptual problems,

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[26]Louise H. Falik, "The Effects of Special Perceptual-Motor Training in Kindergarten on Second Reading Grade Performance," Journal of Learning Disabilities, 2:395-402, August, 1969.

[27]Roger Mitchell Bennett, "A Study of the Effects of a Visual Perception Training Program Upon School Achievement, IQ, and Visual Perception," Dissertation Abstracts, 29:3864-A, May, 1969.

but that it appears to have little influence on the normal student's academic achievement.

In summary, results of studies to evaluate the effectiveness of perceptual-motor training programs in improving academic achievement and ameliorating perceptual-motor deficits are contradictory. The programs were found to be of very definite value by five researchers, while three others found conflicting results. Several studies revealed that the perceptual-motor programs improved perceptual-motor skills but not academic achievement; two others concluded that neither perceptual-motor nor academic skills were affected. Four of the studies dealt exclusively with visual-perceptual training, and three found no significant improvement in visual perception or academic achievement. The fourth resulted in improved visual-perceptual ability only.

COMPARISONS OF PERCEPTUAL-MOTOR ABILITIES OF NORMAL AND LEARNING DISABLED STUDENTS

Studies to compare perceptual-motor abilities of normal and learning disabled students are somewhat limited. Of those that have been done, many have dealt with visual perception only: fewer have investigated perceptual-motor skills on the gross level. Results of the studies are contradictory.

A study by Lachmann[28] compared retarded readers with normal students and emotionally disturbed students with normal reading abilities. The Bender Gestalt Test was used to determine the perceptual abilities of the three groups, and the reading disability group made a significantly greater number of errors than either of the other two groups.

Weathers[29] administered the Stanford Achievement Test reading subtests and the Marianne Frostig Developmental Test of Visual Perception to a group of adequate and a group of inadequate fifth grade readers. The good readers performed significantly higher on subtests of eye-motor coordination and perception of figure ground than did the poor readers. Visual-perception was also found to be positively related to reading level.

Coleman[30] gave the S.R.A. Primary Mental Abilities Test, which includes a subtest for measuring perceptual acuity, to twenty boys retarded in reading. They were seven to eleven years old and had IQ scores

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[28]Frank M. Lachmann, "Perceptual-Motor Development in Children Retarded in Reading Ability," Journal of Consulting Psychology, 24:427-431, October, 1960.

[29]Lillian Louise Weathers, "A Comparison of Visual-Perceptual Development and Reading Achievement of Fifth Grade Adequate and Inadequate Readers," Dissertation Abstracts, 27:2756-A, March, 1967.

[30]James C. Coleman, "Perceptual Retardation in Reading Disability," Perceptual and Motor Skills, 9:117, June, 1959.

of ninety to one hundred fifty. Scores on the perceptual acuity subtest ranged from the second percentile to the eighty-ninth, and only four of the subjects scored above the fiftieth percentile. In light of the above-average intelligence of the subjects, Coleman concluded that marked retardation in visual-perception is a characteristic of reading disability.

The relationship of undifferentiated handedness, perceptual development, and reading disabilities were investigated by Trieschmann.[31] She divided sixty second and third grade boys into two groups based on their reading abilities. They performed a series of motor tasks with each hand to determine handedness. The perceptual task consisted of matching a standard form with comparison forms. Handedness did not appear to be involved in ability to perform the perceptual task. Problem readers had a higher total perceptual error rate than the normal readers.

Keogh and Keogh[32] compared retarded readers (ages nine and ten) and normal readers (ages six to nine) on fine as well as gross perceptual-motor tasks.

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[31]Roberta Barbara Trieschmann, "The Relationship of Undifferentiated Handedness and Perceptual Development in Children with Reading Problems," Dissertation Abstracts, 27:1674-A, December, 1966.

[32]Barbara K. Keogh and Jack F. Keogh, "Pattern Copying and Pattern Walking Performance of Normal and Educationally Subnormal Boys," American Journal of Mental Deficiency, 71:1009-1013, May, 1967.

The subjects were evaluated on their ability to copy four simple line patterns by drawing and by walking. The poor readers performed at a level similar to six year old normal readers on both tasks. They were significantly worse than all other age groups, and were less able to walk than draw the pattern. The investigators suggest that the disabled students had extreme difficulty in organizing gross movements to represent patterns in a larger spatial field.

Motor proficiency and reading abilities were compared by Lewis, Bell, and Franklin.[33] They administered the Lincoln-Oseretsky Motor Developmental Scale and the Iowa Test of Basic Skills to a group of adequate readers and a group of inadequate readers. The inadequate readers performed significantly less ($p < .001$) on the Lincoln-Oseretsky: there was a significant difference between the two groups on more than 50 percent of the items of locomotion, bilateral movements, synchrony, and sequencing of motor skills.

In another study by Lewis, Bell, and Anderson[34] the Lincoln-Oseretsky Scale was again used, this time

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[33] F. D. Lewis, D. B. Bell, and R. P. Anderson, "Relationship of Motor Proficiency and Reading Retardation," Perceptual and Motor Skills, 31:395-401, October, 1970.

[34] F. D. Lewis, D. B. Bell, and R. P. Anderson, "Reading Retardation: a Bi-Racial Comparison," Journal of Reading, 13:433-478, March, 1970.

to compare adequate and inadequate readers within two racial groups, Caucasian and Negro. Inadequate readers had significantly lower scores on the Lincoln-Oseretsky than did adequate readers, regardless of race, thus supporting the previous study.

Weber[35] also used the Lincoln-Oseretsky Scale as well as a measure of laterality and dominance, in comparing motor abilities of subjects with operant language disorders with those of normal children. The language disabled subjects experienced extreme difficulty on the Motor Development Scale: no learning disabled subject performed above the twenty-third percentile.

Lovell and Gorton[36] compared normal and backward readers, ages nine and ten, on a battery of tests, including measures of visual-perception and motor abilities. Significant differences were found between the groups on all the tests except the Bender Gestalt Test, with the normal students performing at a higher level in every case. A correlational analysis also revealed higher intercorrelations among scores of the

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[35]Marylou Adam Weber, "The Motor Behavior Characteristics of Children with Operant Language Disorder," Dissertation Abstracts, 27:2381-A, February, 1967.

[36]K. Lovell and A. Gorton, "A Study of Some Differences Between Backward and Normal Readers of Average Intelligence," British Journal of Educational Psychology, 38:240-248, November, 1968.

retarded readers than among scores of normal subjects.

Clarke and Jarman[37] used a slightly different approach in their study. They divided boys ages nine, twelve, and fifteen into a series of high and low groups based on three strength and two growth measures. Each pair of high and low groups was equated on IQ. When academic achievement of the two groups was contrasted there was a consistent and significant tendency for the high groups to have higher means on standard achievement tests and grade point averages.

Results of the study by Cellura and Butterfield[38] are contradictory to those of studies discussed above. They found no significant difference in performances on the Bender Gestalt Test by mildly retarded children with poor reading skills and mildly retarded children with good reading skills. The investigators suggest that the kind of visual-motor coordination tapped by the Bender Gestalt is different from that required for reading proficiency. Schellenberg[39] reached similar

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[37] H. Harrison Clarke and Boyd O. Jarman, "Scholastic Achievement of Boys 9, 12, and 15 Years of Age as Related to Various Strength and Growth Measures," Research Quarterly, 32:155-162, May, 1961.

[38] A. Raymond Cellura and Earl C. Butterfield, "Intelligence, the Bender-Gestalt Test, and Reading Achievement," American Journal of Mental Deficiency, 71:60-63, July, 1966.

[39] Ernest David Schellenberg, "A Study of the Relationship Between Visual-Motor Perception and Reading Disabilities of Third Grade Pupils," Dissertation Abstracts, 23:3785, April, 1962.

conclusions. He tested third grade retarded readers and normal readers on the Bender Gestalt Test and the Frostig Test of Visual-Perception. Neither test differentiated between adequate and retarded readers.

Van de Riet and Van de Riet[40] hypothesized that children with learning disabilities would have significantly more difficulty in visual-motor coordination than would normal students. Their study, however, did not support the hypothesis. Fourth, fifth, and sixth grade boys with learning problems did not score any worse on the Ellis Visual Designs Test than did normal subjects. The investigators concluded that severe underachievers are probably not held back because of poor visual-motor coordination.

A total school population was studied by Werner, Simonian, and Smith.[41] Children in the upper elementary grades were tested in reading achievement, perceptual-motor development, and language habits. Of two hundred forty-two children found to have poor reading grades, only ten had average or above average intelligence and four or more Bender Gestalt errors. The reading level

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[40]Vernon Van de Riet and Hani Van de Riet, "Visual-Motor Coordination in Underachieving and 'Normal' School Boys," Perceptual and Motor Skills, 19:731-734, December, 1964.

[41]Emmy E. Werner, Ken Simonian, and Ruth S. Smith, "Reading Achievement, Language Functioning, and Perceptual-Motor Development of 10 and 11 year Olds," Perceptual and Motor Skills, 25:409-420, October, 1967.

of these ten students might be attributed to faulty perceptual-motor processes, but inadequacy in language function characterized the majority of the poor readers.

Albright[42] found no difference in performance by normal and disabled readers on five tests of perception. She dealt with ten year old boys and concluded that disturbed visual perception was not a significant factor contributing to their reading problems. Likewise, Bihlmeyer[43] found little difference in motor abilities of achievers and non-achievers. He administered the Lincoln-Oseretsky Motor Development Scale to fourth graders and grouped them according to motor ability. Those pupils with a high level of motor ability differed in writing and drawing from the low group, but there was no difference in mental ability, reading, or general achievement.

The majority of studies comparing perceptual-motor abilities of learning disabled students and normal achievers have dealt with visual perception rather than gross perceptual-motor ability. Four studies have shown

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[42]Mary Joan Albright, "Visual Perception in Children of Retarded and Normal Reading Ability," Dissertation Abstracts, 27:2128-B, December, 1966.

[43]Earl Walter Bihlmeyer, "A Study of the Relationships Between Motor Ability and the Performance of Male Fourth Grade Pupils in Selected School Skills," Dissertation Abstracts, 26:4436, February, 1965.

that the learning disabled subjects had significantly poorer visual-perceptual abilities than normal subjects, while six revealed no difference in the two groups. Of the studies which compared gross perceptual-motor abilities, five indicated that learning disabled subjects had poorer gross perceptual-motor skills than normal subjects, and only one found no difference between the two groups.

RELATIONSHIP OF PERCEPTUAL-MOTOR ABILITIES AND ACADEMIC ACHIEVEMENT

A great many studies have been done in an attempt to determine the relationship of perceptual-motor abilities and academic achievement. Some have dealt with visual perception alone, while others have investigated relationships between visual perception, gross perceptual-motor skill, and academic achievement. As in other types of studies discussed previously, results are contradictory.

Rudnick, Sterritt, and Flax[44] gave three perceptual tests, an IQ test, and a reading comprehension test to third grade boys. Two of the perceptual tests were found to be significantly independent predictors

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[44] Mark Rudnick, Graham M. Sterritt, and Morton Flax, "Auditory and Visual Rhythm Perception and Reading Ability," Child Development, 38:581-587, 1967.

of reading scores. Feldman[45] gave visual-perceptual, intelligence, and reading tests to children in grades kindergarten through twelve and found similar results. Reading skills showed a positive relationship to general visual-perception and the relationship was maintained at all grade levels.

Fourteen tests of visual-perception which had been selected by a panel of experts were used in a study by Goins.[46] She related them to performance of first graders on the Chicago Reading Tests, and found that a greater relationship existed between visual-perception and academic achievement than between IQ and academic achievement.

Polenz[47] gave visual-perceptual tests and the Gray Oral Reading Test to second graders to determine relationships between specific aspects of visual-perception and specific reading errors. Significant relationships were found to exist between eye-motor

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[45]Shirley Clark Feldman, "Visual-Perceptual Skills of Children and Their Relation to Reading," Dissertation Abstracts, 22:1084, July, 1961.

[46]Jean Turner Goins, Visual Perceptual Abilities and Early Reading Progress, (Chicago: University of Chicago Press, 1958).

[47]Ralph J. Polenz, "An Analysis of the Performance of Second Grade Boys with Visual-Perceptual Deficiencies and Second Grade Boys with Satisfactory Visual-Perception on the Gray Oral Reading Test," Dissertation Abstracts, 29:2447-A, February, 1969.

coordination, figure ground perception, constancy of shape, and specific reading errors of gross mispronunciation and insertion, as well as total number of reading errors.

The ability to copy geometric figures was the test of visual-perception used in a correlational study by Justison.[48] She chose four geometric figures from the Bender Gestalt Test, one from the Ellis Visual-Motor Test, and one from the Stanford Binet Intelligence Test. A significant positive correlation between pattern copying and academic achievement of her third grade subjects was found. Barrett[49] also found a significant positive correlation between pattern copying and two measures of reading achievement. He dealt with first graders.

Eastham[50] gave ten perceptual-motor tests to her first through third grade subjects. Five of the tests were fine perceptual-motor activities and five

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[48]Gertrude G. Justison, "Visual Perception of Form and School Achievement (An Exploratory Study of the Relationship Between Form Perception and School Achievement Among Third Grade Pupils in the Public Schools of Montgomery County, Maryland)," Dissertation Abstracts, 22:1907, November, 1961.

[49]Thomas Clifford Barrett, "The Relationship Between Selected Reading Readiness Measures of Visual Discrimination and First Grade Reading Achievement," Dissertation Abstracts, 24:193, July, 1963.

[50]Pauline Dunklin Eastham, "Differences in Perceptual-Motor Abilities of Achievers and Non-Achievers in the First Three Grades," Dissertation Abstracts, 28:5202-B, June, 1968.

required gross motor skills and coordination. Scores on the perceptual-motor tests correlated with the actual academic achievement level of the subjects.

Plack[51] administered the Purdue Perceptual Motor Survey, several subtests of the Johnson Motor Ability Test, and the Stanford Achievement Test to a group of fourth graders. The Purdue Perceptual Motor Survey showed significant positive relationships to the measures of academic achievement and motor skills.

Plack[52] dealt with strictly gross motor activities in another study. She evaluated first, third, and fifth graders on the Iowa Test of Basic Skills for Reading Achievement and the Johnson Motor Achievement Battery for motor skills. She found highly significant correlation coefficients for reading and the throw and catch test and reading and the zig-zag run test. There was, however, little or no relationship between reading and kicking or reading and the jump and reach test. She concluded that reading achievement is related to selected motor skills.

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[51]Jeralyn J. Plack, "An Evaluation of the Purdue Perceptual Motor Survey as a Predictor of Academic and Motor Skills," Dissertation Abstracts, 31:5184-A, April, 1971.

[52]Jeralyn J. Plack, "Relationship Between Achievement in Reading and Achievement in Selected Motor Skills in Elementary School Children," Research Quarterly, 39:1063-1068, December, 1968.

Kirkendall[53] supported the relationship between academic achievement and motor abilities. He measured eight intellectual, twenty-one motor, and thirteen personality variables of fifth and sixth grade students. Motor coordination variables, expecially those performed by the arms, were consistently correlated positively with intellectual variables. Yoder[54] found a similar relationship, although the ability to coordinate the lower limbs (rather than the arms, as in the previous study) had a higher relationship with academic achievement, than any of the other non-intellectual variables. He tested fourth and fifth graders on IQ, academic achievement, and thirty-two motor items.

Schorr and Svagr[55] investigated a wide range of perceptual-motor skills and their relationship to reading comprehension and accuracy of second grade children. Tests of gross motor performance, directional orientation,

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[53]Don Raymond Kirkendall, "The Relationships Among the Motor, Intellectual, and Personality Domains of Development in Pre-Adolescent Children," Dissertation Abstracts, 29:3860-A, May, 1969.

[54]Jay Harold Yoder, "The Relationship Between Intellectual and Non-Intellectual Performance," Dissertation Abstracts, 29:2556-A, February, 1969.

[55]Robert H. Schorr and Virginia B. Svagr, "Relationship of Perceptual and Visual Skills with Reading Accuracy and Comprehension," Journal of American Optometric Association, 37:671-677, 1966.

form perception, visual efficiency, and hand-eye coordination were included. The total perceptual score correlated .76 with reading accuracy and .28 with reading comprehension.

Ismail has done a great deal of work in the area of perceptual-motor abilities and academic achievement. In a study with Gruber[56] he administered thirty-six motor and physical items and IQ and achievement tests to a group of subjects. They found that speed, accuracy, power, strength, and kinesthesia were not related to IQ scores or academic achievement. However, coordination items, especially asymmetrical hopping patterns, and some balance items were found to be related to both IQ and academic achievement. Ismail, Kane, and Kirkendall[57] replicated the study with English subjects and found similar relationships.

Walters[58] found that a visual-perceptual test was related to balance and reading achievement of second graders, but that balance was not related to reading.

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[56] A. H. Ismail and Joseph J. Gruber, Integrated Development (Columbus, Ohio: Charles E. Merrill Books, Inc., 1967).

[57] A. H. Ismail, John Kane, and D. R. Kirkendall, "Relationships Among Intellectual and Non-Intellectual Variables," Research Quarterly, 40:83-92, March, 1969.

[58] C. Etta Walters, "Reading Ability and Visual-Motor Function in Second Grade Children," Perceptual and Motor Skills, 13:370, December, 1961.

Tests used in the study included the Memory-For-Designs test and measures of static and dynamic balance.

Budde[59] administered five motor tests (ball bounce and catch, balance beam, disc obstacle test, wall-kick volley, and hurdle jump test) to kindergarten children. She compared their scores to scores on achievement tests and found only a low relationship. Performance on all five of the motor tests showed a better relationship to academic achievement than any single motor test.

MacLaughlin[60] administered the Purdue Perceptual Motor Survey and the Metropolitan Readiness Test to a group of first grade students during the fall and the Purdue Perceptual Motor Survey and the Metropolitan Achievement Test during the spring. The Perceptual Survey showed a marked positive relationship to the readiness test, but failed to surpass the readiness test in correlation with the achievement test. MacLaughlin concluded that the relationship of perceptual-motor ability and academic achievement was questionable.

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[59]Elaine Helen Budde, "The Relationship Between Performance of Kindergarten Children on Selected Motor Tests and the Metropolitan Readiness Tests and Otis-Lennon Mental Ability Test," Dissertation Abstracts, 31:5820-A, May, 1971.

[60]Sandra MacLaughlin, "An Evaluation of the Purdue Perceptual Motor Survey," Unpublished Master of Science Thesis, Old Dominion College, July, 1969.

The Purdue Perceptual Motor Survey was used by Gillion[61] in a study to determine relationships between perceptual-motor abilities and academic achievement of Negro children. Some significant relationships were found, but they were only between subtests involving fine perceptual-motor skills and academic achievement. Balance and posture, and body image and differentiation were unrelated to scholastic measures.

A study by Copple[62] is perhaps one of the least supportive of a relationship between motor and academic skills. The investigator administered a battery of IQ, achievement, personality, and motor tests to fifth grade boys. Only one motor task (left hand grip strength) was significantly correlated with reading achievement. All other correlations were low, and as many were negative as positive. Copple suggested that compensation for low athletic/motor competency may be made through reading achievement.

Results of two studies dealing with visual-perception have suggested that maturation plays a role in the relationship of perceptual processes and academic

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[61]Hanna E. J. Gillion, "The Relationship Between Perceptual-Motor Ability and Academic Achievement of Certain Disadvantaged Rural Negro Children," Dissertation Abstracts, 31:1601-A, October, 1970.

[62]Lee Biggerstaff Copple, "Motor Development and Self-Concept as Correlates of Reading Achievement," Dissertation Abstracts, 22:1241, July, 1961.

achievement. Chang and Chang[63] gave the Bender to second and third grade students. A significant relationship existed between Bender scores and second grade achievement, but there was no relationship between Bender scores and third grade achievement. Data for younger superior students was also found to be similar to that of older pupils of average ability, again suggesting the maturation factor. Santoro[64] tested first through fourth graders and found that California Reading Test scores correlated significantly with total visual-perception test scores .653 at the first grade level, .438 at the second grade level, and not at all at the third or fourth grade level.

Singer's[65] study, however, contradicts those by Chang and Chang and Santoro. He measured strength factors, motor ability, perceptual ability, and academic achievement in the third and sixth grade students. He found that interrelationships of the experimental variables

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[63]Thomas M. C. Chang and Vivian A. C. Chang, "Relation of Visual-Motor Skills and Reading Achievement in Primary Grade Pupils of Superior Ability," Perceptual and Motor Skills, 24:51-53, February, 1967.

[64]Roseann Marie Santoro, "The Relationship of Reading Achievement to Specific Measures of Visual Perception, Visual-Motor Perception, and Intelligence," Dissertation Abstracts, 28:4010-A, April, 1968.

[65]Robert N. Singer, "Interrelationship of Physical, Perceptual-Motor, and Academic Achievement Variables in Elementary School Children," Perceptual and Motor Skills, 27:1323-1332, December, 1968.

were no higher at the third grade level than at the sixth. Those tasks which were more perceptually oriented correlated no higher with academic achievement than did simple motor and physical characteristics. In this case, maturation did not appear to be involved unless it had been involved before the third grade level.

Todd[66] sought to determine the relationship between specific measures of visual-perceptual abilities and amount of reading retardation defined in terms of discrepancy between expected and actual reading achievement. Fourth and fifth graders with reading difficulties were given the Developmental Test of Visual Perception; only the eye-motor coordination subtest was related to amount of reading retardation. Individual scores indicated that some children with less than one year of reading retardation scored as low as retarded readers on the visual perception test. This indicates that the same level of proficiency in visual-perception is not necessary for all pupils.

Several other researchers have concluded that little or no relationship exists between perceptual-motor abilities and academic achievement. Silberberg[67]

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[66]Eleanor Ardice Todd, "A Clinical Study of the Developmental Test of Visual Perception and Its Relationship to Reading Retardation and Specific Reading Skills," Dissertation Abstracts, 30:629-A, August, 1969.

[67]Norman Esau Silberberg, "An Investigation to Identify Intellectual and Perceptual Correlates of Disability in Word Recognition," Dissertation Abstracts, 26:878, August, 1965.

found that scores on the Bender Gestalt Test were almost totally unrelated to the existence or amount of reading retardation of primary grade students. Bauer[68] tested sixth graders and found no relationship between perceptual-motor abilities and mental capacity or mental achievement. Haring and Ridgway[69] administered an extensive battery of tests to kindergarten children that appeared to be potential poor achievers. None of the perceptual-motor tests correlated significantly with academic abilities. In addition there was no correlation among tests which purported to measure the same or similar abilities. Trussell[70] concluded from her study with first and second graders that reading development, perceptual development, and motor development are more likely to exhibit independence than association.

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[68]Raymond Edwin Bauer, "A Study of the Motor Achievement and Mental Achievement of Sixth Grade Children," Dissertation Abstracts, 22:3510, February, 1962.

[69]Norris G. Haring and Robert W. Ridgway, "Early Identification of Children With Learning Disabilities," Exceptional Children, 33:387-395, February, 1967.

[70]Ella M. Trussell, "Relation of Performance of Selected Physical Skills to Perceptual Aspects of Reading Readiness in Elementary School Children," Research Quarterly, 40:383-390, May, 1969.

Klausmeier, Lehmann, and Beeman[71] tested the hypothesis that a low level of physical development or uneven physical development within a child would accompahy low achievement in arithmetic and reading. They measured height, strength, grip strength, number of permanent teeth, and bone development in wrists and hands and found no significant relationship between these measures and academic achievement.

Thompson[72] found more negative relationships between motor performance and mental achievement than positive ones. She gave tests in motor skills and academic achievement to second, fourth, and sixth graders. The beam walk and arithmetic skills of fourth graders and language study skills of sixth graders were the only significant positive relationships found. The hurdle jump had a singificant negative relationship to all academic subtests except one, and agility was negatively related to language, spelling, reading, and study skills of fourth and sixth graders.

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[71]Herbert J. Klausmeier, Irvin J. Lehmann, and Alan Beeman, "Relationships Among Physical, Mental, and Achievement Measures in Children of Low, Average, and High Intelligence," American Journal of Mental Deficiency, 63:647-656, January, 1959.

[72]Margaret Madeline Thompson, "A Study of the Relationship Between Performance in Selected Motor Skills and Mental Achievement of Children of Elementary School Age," Dissertation Abstracts, 22:1505, November, 1961.

The numerous correlational studies which have been done present conflicting results. Six showed a significant positive relationship between visual-perception and academic achievement, while three did not. Four showed a significant positive relationship between gross perceptual-motor ability and academic success, while five did not. In three cases, achievement in school was shown to be related to selected motor skills only. Visual-perceptual abilities, but not motor skills, related to school achievement in two studies, and in two other studies gross perceptual-motor skills and visual perception were found to be unrelated. Several studies dealt with the role of maturation in these relationships. Two found perceptual-motor abilities and academic achievement to be more related in younger than older students, while a third study found that the extent of the relationship varied little from age group to age group.

Chapter 3

METHODOLOGY

Fifteen learning disabled students and fifteen normal students were given the Bender Gestalt Test, the Six Category Gross Motor Test, and the Purdue Perceptual Motor Survey. Performances by the two groups were compared, using the appropriate statistical test, and a correlational analysis was made to determine relationships existing among total test scores.

PROCEDURE

Selection of Subjects

Fifteen male students, ages eleven and twelve and with IQ scores of ninety or above, were randomly selected from the Academic II and III classes at the Diagnostic Special Education School of Tidewater Rehabilitation Institute in Norfolk, Virginia. Table 1 provides more complete information concerning ages and IQ scores of the subjects. No students with physical impairments or severe emotional problems were included. All had been placed in the classes on the basis of poor achievement while attending a public school. This group was designated the learning disabled group.

The normal group was composed of fifteen students of similar age and IQ as those above. They are described more fully in Table 1. They were randomly selected from among sixth grade boys at Alvin Elementary School in Alvin, Texas. No students who had severe emotional problems or physical handicaps were included, and all were believed to be achieving normally by their classroom teachers.

Table 1

Means, Standard Deviations, and Ranges of Ages and IQ Scores of Learning Disabled and Normal Subjects

	Learning Disabled		Normal	
	Age	IQ	Age	IQ
Mean	11-7*	96	11-8	96
S.D.	2-0	11	1-8	11
Range	11-1 - 12-10	90-120	11-2 - 13-0	90-120

*In years and months

Administration of Tests

All tests were administered individually to the subjects by the investigator. The learning disabled group was tested in the Motility Room at Tidewater Rehabilitation Institute and the normal subjects were

tested in the Apparatus Room at Alvin Elementary School. Each subject was given the Bender Gestalt Test and the Six Category Gross Motor Test during one testing period and the Purdue Perceptual Motor Survey during another testing period. The tests were not administered during the same testing period in order to avoid fatiguing the subjects.

The Bender Gestalt Test was administered according to instructions in the test manual.[1] Each subject was given several sheets of paper and two pencils and was instructed to copy the nine figures comprising the test. No time limit was set and the subject was allowed to erase or repeat figures with which he was not satisfied.

Cratty's Six Category Gross Motor Test was administered immediately following completion of the Bender Gestalt, and procedures outline by Cratty were followed.[2] The activities to be performed were explained and demonstrated by the investigator. Equipment used included a 4X6 foot mat, a watch with a second hand, an eight inch rubber playground ball, and a softball hung on a string. All materials were as specified in

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[1] Elizabeth M. Koppitz, The Bender Gestalt Test for Young Children (New York: Grune and Stratton, Inc., 1964).

[2] Bryant J. Cratty, Perceptual-Motor Behavior and the Educational Processes (Springfield, Illinois: Charles C. Thomas, 1969).

the testing instructions.

The Purdue Perceptual Motor Survey was administered during a second testing session. All instructions were given as directed in the test manual[3] and no demonstrations of the activities were made unless the subject failed to approach a correct performance on several attempts. The equipment used was in accordance with Kephart's specifications with the exception of the walking board (a six inch board was used rather than the recommended four inch board because of availability) and the pen light (a pencil with a large thumb tack attached to one end was used). Other equipment included a thirty-six inch broom handle, a small mat, a large chalkboard and two pieces of chalk, and paper and pencils.

COLLECTION OF THE DATA

All scoring was done according to instructions in the test manuals. Scores were recorded on individual and group score cards; examples of them may be found in Appendixes A, B, C, and D, pages 72, 73, 74, and 75.

Briefly, the Bender Gestalt Test is scored in

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[3]Eugene G. Roach and Newell C. Kephart, The Purdue Perceptual-Motor Survey (Columbus, Ohio: Charles E. Merrill Books, Inc., 1966).

terms of number of errors present in a subject's drawings. The scoring manual enumerates thirty distortion, perseveration, rotation, and integration errors which might be made, and each is worth one point. Higher scores denote poorer performances.

The Six Category Gross Motor Test consists of two levels and both were administered to every subject. Cratty lists specific actions to watch for, and points are awarded or taken away accordingly. For each subtest, a maximum of ten points can be made, five at level I and five at level II. A total of sixty points can be made on the entire test, with the higher scores signifying better performances.

Scoring procedures for the Purdue Perceptual-Motor Survey are similar to those of Cratty's test. Kephart describes actions which should or should not be present in one's performance of the various activities. Four points are awarded for acceptable performances of the specific subtests and points are taken away on poorer performances. A total of eighty-eight points can be scored on the test.

ANALYSIS OF THE DATA

All analyses were done by computer at the Old Dominion University Computer Center. The mean, standard deviation, and standard error of the mean were computed for each group's total test scores. An independent group t test

was used to compare performance by the learning disabled group and the normal group on each of the three tests. A two-tailed test at twenty-eight degrees of freedom was used to test the differences at the .05 level.

Pearson Product Moment correlation coefficients were computed to determine the extent of any relationships existing between pairs of total test scores. Relationships were investigated for both groups separately and for the total thirty subjects. Correlation coefficients were tested at the .05 level.

Chapter 4

RESULTS AND DISCUSSION

Independent group t tests were used to compare performances of a group of learning disabled and normal students on three tests of perceptual-motor ability. Pearson product-moment correlation coefficients were also computed in order to determine relationships existing among the tests.

COMPARISON OF THE GROUPS

Analysis of the data revealed differences in performance significant at the .05 level on the Purdue Perceptual Motor Survey and the Six Category Gross Motor Test. Difference in performance on the Bender Gestalt Test was significant at the .1 level. In each case, the normal group performed better than the learning disabled group, and the hypothesis stating that no difference would exist between the groups was rejected. Means, standard deviations, and t ratios are contained in Table 2, and indivdiual test scores are located in Appendix E, page 76.

Table 2

Means, Standard Deviations, and t Ratios of Test Scores

	L. D.		Normal		t
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	
BG	4.1	4.1	1.9	1.8	1.8479[a]
SCGMT	47.6	6.2	52.3	3.8	2.5267[b]
PPMS	66.1	10.3	73.4	7.0	2.2841[b]

[a] p .1; df=28, t=1.701
[b] p .05; df=28, t=2.048

CORRELATIONAL ANALYSIS

Correlation coefficients were computed for the total group, the learning disabled group, and the normal group. All coefficients are contained in Table 3. One should note that all correlations involving the Bender Gestalt Test are negative because high scores on the test denoted poor performance.

For the total group of subjects, all correlation coefficients were significant beyond the .001 level. The hypothesis stating that there would be no relationship among the tests was rejected.

All correlation coefficients for the learning

disabled group were significant beyond the .01 level. The hypothesis stating that there would be no relationship among the tests was rejected.

Correlations for the normal group were lower than those for the total group and the learning disabled group. Those for the Bender Gestalt Test and the Purdue Perceptual Motor Survey and the Six Category Gross Motor Test and the Purdue Perceptual Motor Survey were significant at the .05 level. In these two cases, the hypothesis stating that no significant relationships would exist among the tests was rejected. The correlation coefficient for the Bender Gestalt Test and the Six Category Gross Motor Test was not significant, and the null hypothesis was accepted.

Table 3

Correlation Coefficients

	Learning Disabled			Normal			Total		
	PPMS	BG	SCGMT	PPMS	BG	SCGMT	PPMS	BG	SCGMT
BG	-.6908[c]			-.5470[b]			-.6915[c]		
SCGMT		-.8320[c]			-.4254			-.7710[c]	
PPMS			.7025[c]			.5998[b]			.7273[c]

[b] p .05; df=13, r=.5139
[c] p .01; df=13, r=.6411

DISCUSSION

The normal group of students performed significantly better on the Six Category Gross Motor Test and Purdue Perceptual Motor Survey than the learning disabled group. These results indicate that there is a difference in the perceptual-motor abilities of the two groups of students. Because the test items on the Purdue Perceptual Motor Survey were selected on the basis of their relationship to academic achievement, one might expect to find that poor achievers would perform worse on the Survey than would average students. Cratty, however, chose items for the Six Category Gross Motor Test on the basis of their relationship to success on the playground. Finding that poor academic achievers also perform below normal students on this test indicates that this special group of students could indeed use a specialized physical education program, whether it would enhance academic success or not.

Difference in performance on the Bender Gestalt Test is less extreme. From previous studies, maturation would appear to be more involved in this test of fine visual-perceptual motor ability. Chang and Chang[1] found a significant relationship between Bender scores and

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[1]Thomas M. C. Chang and Vivian A. C. Chang, "Relation of Visual-Motor Skills and Reading Achievement in Primary Grade Pupils of Superior Ability," Perceptual and Motor Skills, 24:51-53, February, 1967.

Trussell[3] found that perceptual development and motor development exhibit independence rather than association, and Haring and Ridgway[4] found no relationships between the Bender Gestalt Test and similar tests of visual perception and the Purdue Perceptual Motor Survey. Kephart,[5] on the other hand, bases his entire theory concerning learning disabilities on the proposed relationship between motor ability and visual perception.

In the normal group, the correlations for all pairs of tests but the Bender Gestalt and Six Category Gross Motor Test were significant at the .05 level. No significant relationship existed between the Bender and the Gross Motor Test. For this group, there appears to be no relationship between visual-perception and gross motor ability. Lovell and Gorton[6] found similar results, with higher intercorrelations of

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[3]Ella M. Trussell, "Relation of Performance of Selected Physical Skills to Perceptual Aspects of Reading Readiness in Elementary School Children," Research Quarterly, 40:383-390, May, 1969.

[4]Norris G. Haring and Robert W. Ridgway, "Early Identification of Children with Learning Disabilities," Exceptional Children, 33:387-395, February, 1967.

[5]Newell C. Kephart, The Slow Learner in the Classroom (Columbus, Ohio: Charles E. Merrill Books, Inc., 1969).

[6]K. Lovell and A. Gorton, "A Study of Some Differences Between Backward and Normal Readers of Average Intelligence," British Journal of Educational Psychology, 38:240-248, November, 1968.

test items for retarded readers than normal readers. They suggest that this greater clustering in the backward readers throws light on the etiology of reading problems. Many educators[7] have suggested that learning disabilities are due to a central nervous system defect which affects both fine and gross perceptual-motor function.

In an entirely subjective analysis of the tests, the Six Category Gross Motor Test was found to be more easily administered and objectively scored than the Purdue Perceptual Motor Survey. The norms for Cratty's test include a wider age range and the activities seemed to be of more interest to the subjects. Since the two tests correlate highly, the Six Category Gross Motor Test might be used instead of the more widely used Purdue Perceptual Motor Survey to evaluate gross perceptual-motor functioning and as a basis for development of individualized developmental physical education programs.

In conclusion, the results of the study reveal a difference in perceptual-motor abilities of learning disabled and normal students, suggesting that poor achievers are in need of a special physical education

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[7]James J. McCarthy and Joan F. McCarthy, Learning Disabilities (Boston: Allyn and Bacon, Inc., 1969), pp. 10-13.

program. Visual-perception and perceptual-motor ability are more highly related in the learning disabled group than in the normal group, and the Purdue Perceptual Motor Survey and the Six Category Gross Motor Test appear to be measuring similar or related abilities.

Chapter 5

SUMMARY AND CONCLUSIONS

The purpose of the present study was to compare the perceptual and motor functioning of learning disabled and normal students, and to determine what relationship existed among the various abilities being measured. Fifteen learning disabled students and fifteen normal achievers, all age eleven or twelve, were tested on the Bender Gestalt Test, the Six Category Gross Motor Test, and the Purdue Perceptual Motor Survey. Test scores for the two groups were compared using independent group t tests in order to determine if there were any significant differences between perceptual-motor abilities of the learning disabled and normal students. Results revealed a difference significant at the .05 level for performance on the Six Category Gross Motor Test and the Purdue Perceptual Motor Survey; difference in performance on the Bender Gestalt Test was significant at the .1 level. All differences favored the normal group.

Pearson product-moment correlation coefficients were also computed in order to determine relationships existing among the tests. Within the total group, all

correlations were significant beyond the .001 level; within the learning disabled group, they were significant beyond the .01 level. Correlation coefficients computed for the normal group were significant beyond the .05 level with the exception of the coefficient for the Bender Gestalt Test and the Six Category Gross Motor Test, which is not significant.

Within the limitations of this study, the following conclusions were made:

1. The perceptual-motor abilities of learning disabled students are significantly inferior to those of normal students.

2. There is a significant relationship among the visual-perceptual and gross perceptual-motor abilities measured by the Bender Gestalt Test, the Six Category Gross Motor Test, and the Purdue Perceptual Motor Survey.

3. There is a greater relationship among the various perceptual-motor abilities in the learning disabled student than in the normal student.

RECOMMENDATIONS FOR FUTURE STUDY

To further investigate the possible relationship between perceptual-motor abilities and academic achievement, a longitudinal study would be of value. Students identified in the first grade as having poor perceptual-

motor skills and below average academic achievement should be tested again at the third and sixth grade levels in order to determine if the same relationships exist between perceptual-motor and academic abilities. This would provide information regarding the role of maturation in the relationship.

A correlational study involving the Purdue Perceptual Motor Survey, the Six Category Gross Motor Test, and the Lincoln-Oseretsky Developmental Motor Scale would also be of interest. The Lincoln-Oseretsky Scale was found to be the most frequently used gross motor test, and it is important to ascertain if the various tests of motor ability are measuring the same or related abilities.

Based on the conclusions of this study, further experimentation with gross perceptual-motor training programs is indicated. Various types of programs need to be developed and their effects upon perceptual-motor skills and academic achievement should be carefully investigated and documented.

APPENDIX A

BENDER GESTALT TEST
SCORE SHEET

NAME: _____

GROUP: _____

Figure	Errors
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____

APPENDIX B

SIX CATEGORY GROSS MOTOR TEST SCORE SHEET

SUBJECT:_____

GROUP: _____

SCORES	LEVEL I	LEVEL II
Test 1:	Body Perception	Body Perception
	a. stomach-front _____	a. left arm _____
	b. back _____	b. left leg _____
	c. stomach-legs _____	c. right arm _____
	d. nearest tester side _____	d. left elbow _____
	e. left-side _____	e. left knee _____
Test 2:	Gross Agility (quick get-up) Total Score _____	Gross Agility (kneel and rise) Total Score _____
Test 3:	Balance (eyes open) Total Score _____	Balance (arms folded, eyes closed) Total Score _____
Test 4:	Locomotor Agility (Crawl-hop) Total Score _____	Locomotor Agility (pattern jump-ho Total Score _____
Test 5:	Ball Throwing (form) Total Score _____	Ball Throwing (at target) Total Score _____
Test 6:	Ball Tracking (catching) Total Score _____	Ball Tracking (swinging ball) Total Score _____

Total Points in Battery: Level I_____Level II____

Total Battery_____

APPENDIX C

PURDUE PERCEPTUAL MOTOR SURVEY
SCORE SHEET

SUBJECT: _____

GROUP: _____

SUBTEST	SCORE
Walking board:	
Forward	_____
Backward	_____
Sidewise	_____
Jumping	_____
Identification of body parts	_____
Imitation of movement	_____
Obstacle Course	_____
Kraus-Weber	_____
Angels-in-the-snow	_____
Chalkboard:	
Circle	_____
Double circle	_____
Lateral line	_____
Vertical line	_____
Rhythmic writing:	
Rhythm	_____
Reproduction	_____
Orientation	_____
Ocular pursuits:	
Both eyes	_____
Right eye	_____
Left eye	_____
Convergence	_____
Visual achievement forms:	
Form	_____
Organization	_____

APPENDIX D

GROUP SCORE CARD

GROUP: _____

SUBJECT	BG	SCGMT	PPMS
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

APPENDIX E

	NORMAL			LEARNING DISABLED		
	BG	SCGMT	PPMS	BG	SCGMT	PPMS
1.	1	56	81	0	49	74
2.	1	49	71	5	57	69
3.	3	57	85	1	53	68
4.	6	42	60	8	44	68
5.	3	53	75	5	47	59
6.	0	51	82	1	58	78
7.	2	55	66	1	47	67
8.	0	50	71	6	41	57
9.	1	53	81	3	50	67
10.	5	52	68	14	32	57
11.	3	53	67	10	41	37
12.	0	55	77	0	50	75
13.	1	56	71	0	50	69
14.	1	54	76	3	49	70
15.	2	49	70	4	52	76

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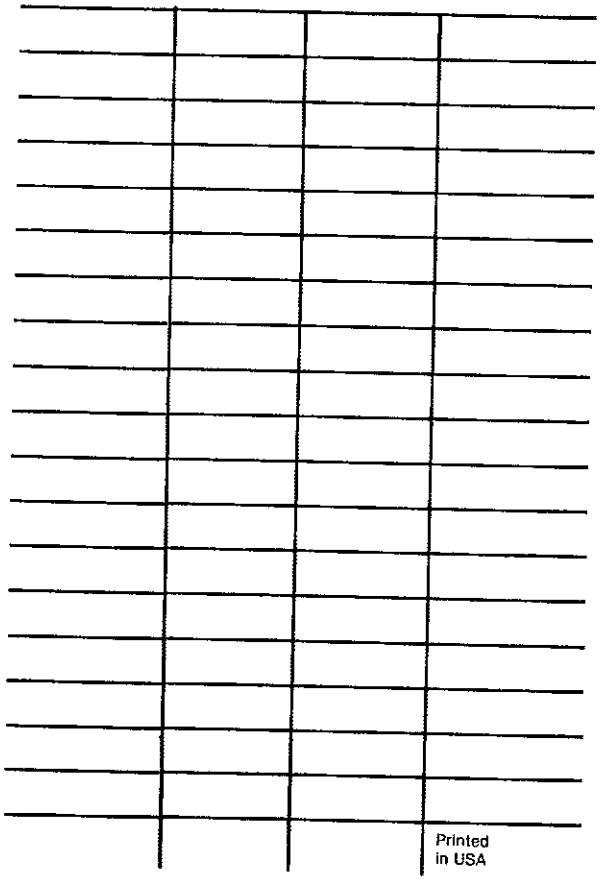

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