ABSTRACT

Mehrman, D. A comparison of the perceptual-motor performance of seven-and eight-year-old learning-disabled and non-handicapped children. M.S. in Physical Education for the Handicapped, 1983, 166 pages. (Dr. Joy C. Greenlee)

The purpose of this study was to determine if differences exist in performance among seven-and eight-year-old children classified as learning-disabled and non-handicapped on the Southern California Perceptual-Motor Tests (SCPMT) and four selected perceptual-motor tasks designed by the researcher. The SCPMT consisted of eight subtests: (1) Position in Space, (2) Motor Accuracy-Revised, (3) Imitation of Postures, (4) Bilateral Motor Coordination, (5) Right-Left Discrimination, (6) Crossing Midline of Body, (7) Standing Balance-Eyes Open, and (8) Standing Balance-Eyes Closed. The four selected perceptual-motor tasks included: (1) a Scooter Activity, (2) a Hopscotch Activity, (3) a Ball Activity, and (4) a Beam Activity. The SCPMT was administered to 37 subjects, and the selected tasks to 31 subjects. The learning-disabled population was chosen first, with the non-handicapped population subsequently selected with an attempt made to correlate the ages, sex, and schools of the learning-disabled and non-handicapped subjects. A two-way ANOVA was computed for the raw scores for each of the eight-subtests of the SCPMT, and a three-way ANOVA with repeated measures was computed for each of the four selected tasks, with two trials per task representing the repeated measures. Results of the statistical analyses revealed consistency in significant between group differences which favored the non-handicapped group in five of the eight SCPMT subtests, while for the tasks they were noted in only the Scooter Activity. Age by group interactions were noted on three of the SCPMT subtests, while none were noted for the selected tasks. The Ball Activity displayed significant between age difference which indicated better performance for the eight-year-old group, while none were evident for the SCPMT. Between trial differences indicating better performance on Trial 2 regardless of age or group were noted on three of the four tasks, while a trial by group interaction was noted on the Beam Activity.

A COMPARISON OF THE PERCEPTUAL-MOTOR PERFORMANCE OF SEVEN-AND EIGHT-YEAR-OLD LEARNING-DISABLED AND NON-HANDICAPPED CHILDREN

A Thesis Presented

to

The Graduate Faculty

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In Partial Fulfillment

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Master of Science Degree

Physical Education for the Handicapped

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by

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CHAPTER I

INTRODUCTION

The relationship between perceptual-motor deficits and academic achievement has been widely researched. Much literature is available pertaining to the perceptual and motor problems of children classified as learning-disabled, as well as the low academic achievement of these children in comparison with their non-handicapped peers. Bruininks and Bruininks (1977), in examining the motor proficiency of children classified as learning-disabled in comparison with that of their non-handicapped peers, concluded the following, "Learning-disabled students performed significantly lower than nondisabled students on measures of fine motor skills and on measures of gross motor skills" (p. 1131). Research similar to this has been completed in the perceptual and visual-motor realms as well. Cratty (1969) stated "it is believed that there are relationships between the quality and quantity of obvious motor output of children and their ability and/or inclination to engage in various tasks within the classroom" (p. 8).

While much literature is available pertaining to perceptual and motor deficits and their relationship to the academic achievement of children classified as learning-disabled, there appears to be less concern toward relating these deficits to the performance of these children in the physical education setting. Quite often, the existence of consistent perceptual and motor problems in the learning-disabled population are acknowledged, but far more emphasis is placed on the academic realm of the problem than the movement performance aspect. If there is a positive correlation between perceptual-motor performance and children classified as learning-disabled, it would follow that identification and remediation of the perceptual and motor deficits displayed by these children, within the physical education classroom, would benefit the child.

Perceptual-motor problems are most often seen in the physical education setting. Children are forced to react motorically to various types of perceptual stimuli: visual, auditory, tactile and kinesthetic. Proper assessment and the incorporation of an appropriate perceptual-motor training program by the physical educator allows the remediation of perceptual-motor deficits to take place in the physical education setting. Gruber (1969) cited Rousseau, Sherrington and Strauss as three educators who "stress the concept that body and mind are not independent" (p. 44). Working on remediation of the academic problems facing the child classified as learning-disabled in the regular classroom while simultaneously working on perceptual-motor training and remediation in the physical education classroom deals with the whole of the problem facing the child. Concern with the academic realm alone does not address the entire problem. It merely addresses one aspect of a problem which is actually three-fold in nature, containing academic, perceptual, and motor considerations which are closely interrelated.

Assessment and identification of the perceptual and motor problems consistently observed in children classified as learning-disabled are necessary for eventual remediation of the problems. Humphrey (1976) stated:

> In general, the current postulation appears to be that if perceptual training improves perceptual and motor abilities, then, because of the fact that perceptual and motor abilities are so highly interrelated and interdependent upon each other, it follows that training in perception should alleviate perceptual-motor problems (p. 15).

As stated earlier, training in perceptual and motor abilities may easily occur in the physical education classroom. Identification of specific perceptual-motor deficits will aid in the remediation of such problems, as additional work and training may then be afforded children with such deficits. It is the role of the physical educator to utilize his/her assessment capabilities to identify these difficulties and plan appropriately for the remediation of such problems. Thus, the implications of physical education for these children contain the following elements: assessment, identification, specific training and remediation of perceptual-motor deficits, all of which are an integral part of the physical education curriculum. It is the aim of this study to identify perceptual-motor differences found in children classified as learning-disabled, as well as identify movement performance difficulties which may be evident in this population, and to discuss the implications of physical education for these children.

Statement of the Problem

The problem of this study was to determine if there is a difference in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Southern California Perceptual-Motor Tests and selected perceptual-motor tasks.

Statement of the Subproblems

The subproblems of this study included the following:

1. Is there a significant difference in performance among seven-and eight-year-old children classified as learning disabled and seven- and eight-year-old non-handicapped children on the Southern California Perceptual-Motor Tests?
2. Is there a significant difference in performance among seven- and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Scooter Activity?
3. Is there a significant difference in performance among seven- and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Hopscotch Activity?
4. Is there a significant difference in performance among seven- and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Ball Activity?
5. Is there a significant difference in performance among seven- and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Beam Activity?

Delimitations of the Study

The following delimitations were identified for this study:

1. The subjects in this study classified as learning-disabled or non-handicapped by the La Crosse School District were between the ages of 7.0 years through 8.11 years old.
2. Children identified by the La Crosse School District as having any type of physical, mental, social or emotional handicapping condition in addition to a learning-disability were excluded from the learning-disabled population.
3. Children identified by the La Crosse School District as having any type of physical, mental, social or emotional handicapping condition were excluded from the non-handicapped population.

Limitations of the Study

The following limitations were identified for this study:

1. The population from which the subjects were chosen was limited in size, based on the age, school, and sex of the child, and determined by permission from the parents and the La Crosse School District.
2. The subjects for this study were not chosen by random sample, but by availability and selection of the non-handicapped children in accordance with the ages, sex and schools of the learning-disabled population, with all subject selection done by the learning-disabilities teachers in the schools involved.
3. The subjects in this study attended, and were tested in, five different school settings.

Assumptions

The following assumptions were made for this study:

1. It was assumed that the subjects chosen for this study were representative of seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children.
2. It was assumed that all subjects involved in this study put forth their best effort on the test items and perceptual-motor tasks presented to them.
3. It was assumed that the Southern California Perceptual-Motor Tests administered in this study provided a reliable, accurate and valid measure of perceptual-motor functioning.
4. It was assumed that the perceptual-motor tasks chosen for this study were not representative of all perceptual-motor tasks, rather, they were specific to this study and correlated with the identified criteria for selection.

Statement of the Hypothesis

The following hypothesis was based upon the problem of this study:

There is no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Southern California Perceptual-Motor Tests and selected perceptual-motor tasks.

Statement of the Sub-Hypotheses

The sub-hypotheses of this study included the following:

1. There is no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven-

and eight-year-old non-handicapped children on the Southern California Perceptual-Motor Tests.

2. There is no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven- and eight-year-old non-handicapped children on the Scooter Activity.
3. There is no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven- and eight-year-old non-handicapped children on the Hopscotch Activity.
4. There is no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven- and eight-year-old non-handicapped children on the Ball Activity.
5. There is no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven- and eight-year-old non-handicapped children on the Beam Activity.

Purpose of the Study

The purpose of this study was to determine if differences exist in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Southern California Perceptual-Motor Tests and selected perceptual-motor tasks. A second purpose of this study was to determine if those differences which occur on the Southern California Perceptual-Motor Tests and selected perceptual-motor tasks increase or decrease with age among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children.

Need for the Study

Federal legislation concerning the education of handicapped children has incorporated the least restrictive environment concept into educational curricula. According to Public Law 94-142:

> SEC. 612. In order to qualify for assistance under this part in any fiscal year, a State shall demonstrate to the Commissioner that the following conditions are met:
> (5) The State has established....(B)procedures to assure that, to the maximum extent appropriate, handicapped children, including children in public or private institutions or other care facilities, are educated with children who are not handicapped, and that special classes, separate schooling or other removal of handicapped children from the regular educational environment occurs only when the nature or severity of the handicap is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily (1975, 89 STAT. 781).

Quite often, the least restrictive concept is incorporated when placing the child into the academic classroom, but not when placement into the physical education classroom is made, as learning-disability difficulties are often considered only within the academic realms where least restrictive placement is concerned. It may be asked, is the normal or general physical education classroom the least restrictive environment for children classified as learning-disabled? Is placement of children classified as learning-disabled in the normal physical education setting meeting the exceptional needs of these children? While the general physical education classroom meets the criterion concerning education with children who are not handicapped, for children classified as learning-disabled who exhibit severe perceptual-motor deficits, the criterion concerning satisfactory educational achievement is not necessarily being met. If the exceptional needs of these children are being met, the deficits in performance that these children display should decrease with age and/or become non-existent, as the children receive instruction and reinforcement from their physical education experiences.

The normal or general physical education setting does not necessarily offer the experience and remediation necessary to improve severe perceptual-motor deficits, whether they are found in children classified as learning-disabled or non-handicapped, without extra instruction in addition to regular class time. Placement in a separate instructional setting away from non-handicapped children may not be appropriate for children classified as learning-disabled, however, placement of these children in a normal physical education classroom without any type of remedial or extra instruction to aid in improving these deficits may be equally inappropriate. It is necessary to differentiate between the learning-disabled and non-handicapped populations in the physical education classroom, as well as to identify those perceptual-motor deficits, if any, that are evident in the learning-disabled population. In this way, the exceptional needs of the child classified as learning-disabled may be focused upon and appropriately planned for, and remediation of those deficits may take place.

In the past, perceptual-motor tests given to children classified as learning-disabled have not necessarily been designed specifically to look at movement deficits in that particular group. Past research has quite often been designed to look at the relationship between perceptual-motor deficits and academic potential or achievement. Research in the area of perceptual-motor deficits, and the relationship of such difficulties with the child classified as learning-disabled, as well as the implications which the physical education classroom has on that relationship, should be designed and explored.

Definition of Terms

The following definitions have been adopted for the purposes of this study:

Eight-year-old-Subjects classified as eight-years-old were between 8 years and 0 months, and 8 years and 11 months of age, with age calculations made to the nearest month.

Seven-year-old-Subjects classified as seven-years-old were between 7 years and 0 months, and 7 years and 11 months of age, with age calculations made to the nearest month.

Learning-disabled-Any child classified as learning-disabled by the La Crosse School District.

Non-handicapped-Any child who was not identified as having any type of exceptional educational need by the La Crosse School District.

Motor learning-"A relatively permanent change in the performance of a motor skill resulting from practice or past experience" (Kerr, 1982, p. 310).

Motor skill-"Any muscular activity that is directed to a specific objective" (Kerr, 1982, p. 310).

Perception-"The active, not the passive, process of interpreting sensory stimuli....Perception involves the conscious organization of incoming information, and it is this perceptual organization that provides the basis for learning" (Kerr, 1982, p. 311).

Perceptual-motor development-"Changes or improvements in the child's afferent or sensori-perceptual capacities. These are changes grounded in a steady and continuous improvement in the child's capacity to perceive (to pick and evaluate internally) increasingly more complex kinds and quantities of sensory information. The concept of perceptual-motor development then is one which deals with changes in the child's capacity for exerting more and more refined afferent control over overt motor behavior" (Corbin, 1980, p. 142).

Perceptual-motor process-"The accurate processing of information that comes to the individual through the sense organs. Response to perceptual-motor processing is based on the individual's past experience. Information coming to the organism through the sense organs must be recognized, identified and discriminated before it can be specifically used by the central nervous system. The information that is processed becomes integrated and compared with previously stored information; then it becomes available for immediate or future use, depending on the needs of the individual" (Arnheim & Sinclair, 1979, p. 11).

Integration-"The interaction and coordination of two or more functions or processes in a manner which enhances the adaptiveness of the brain's response. Through integration a "whole" is either revised or produced from fragmented parts. Information from the environment is organized and interpreted for the planning execution of interaction with the environment, particularly the tangible, three-dimensional, gravity-bound world" (Ayres, 1972a, p. 26).

Intersensory integration-"The ability of the individual to use or integrate multiple sources of sensory information simultaneously to solve problems and/or aid him in adapting to the environment" (Birch & Lefford, 1963, 1967, as cited in Williams, 1982, p. 142).

Kinesthesis-"The awareness of body position and movement based on proprioceptive information" (Kerr, 1982, p. 188).

Proprioception-"Information arising from the body, especially, from muscles, joints, ligaments, and receptors associated with bones.... Many of the proprioceptive sensations either do not reach consciousness, or, like vestibular information, come to awareness only when attention is deliberately focused on them" (Ayres, 1972a, p. 66).

Proprioceptors-"Sensory nerve terminals located in muscles, tendons, joints, and the semicircular canals of the inner ear, providing the organism with a constant stream of information about movement. Without proprioceptors, the body would lose its postural orientation and muscle tone. Without the sense of body orientation and muscle tone, the individual would be unable to maintain equilibrium" (Arnheim & Sinclair, 1979, p. 10).

Southern California Perceptual-Motor Tests-An eight-test battery developed by Ayres to evaluate the perceptual-motor performance of children four to eight years of age on the Imitation of Postures, Crossing Midline of Body, Bilateral-Motor Coordination, Right-Left Discrimination and Standing Balance: Eyes Open and Closed tests; and ages four to ten years on the Position in Space and Motor Accuracy-Revised tests.

Perceptual-motor tasks-Four individual tasks designed by the researcher, which included the following: (1) a Scooter Activity, (2) a Hopscotch Activity, (3) a Ball Activity, and (4) a Beam Activity, to evaluate the perceptual-motor performance of seven-and eight-year-old children on specific tasks.

CHAPTER II

REVIEW OF RELATED LITERATURE

The review of related literature was divided into seven categories as follows: learning-disabilities, the perceptual-motor theory of Dr. A. Jean Ayres, perceptual-motor ability and learning-disabilities, information processing and motor skill performance, learning-disabilities and physical education, federal legislation pertaining to the child classified as learning-disabled, and a chapter summary.

Learning-Disabilities

Learning-disability is a relatively new term, first introduced by Samuel Kirk in 1962. Johnson and Morasky (1980) cited other terms used to label children with learning difficulties: brain-injured child, Strauss Syndrome, neurophrenia, marginal children, and minimal brain dysfunction. The most widely accepted term, learning-disability, began to receive recognition from educators in 1965, gaining acceptance from special educators around 1970, and finally coming into use by the majority of educators in 1975 (Gearheart, 1977).

Much work and research was done in the field of learning-disabilities prior to the introduction of Kirk's term. While most of the acknowledged work in the field has taken place within the twentieth century, Johnson and Morasky (1980) cited the work of Morgan, an opthalmologist, as a possible exception. Morgan's work was published in a British medical journal in 1896 and concerned a disorder he described as "word blindness".

The work of Grace Fernald offered much insight to the field of learning-disabilities. In 1921, Fernald opened the Clinic School, which accepted children with varying disabilities ranging from those classified as trainably mentally retarded to normal children with severe reading problems, as well as epileptics and children with stuttering and severe behavior problems. The Clinic School eventually developed a program geared for children of normal intelligence with severe learning/educational problems. The major disability of children attending the school was in reading, and boys eventually represented the majority of the population. In 1943, Fernald published her book Remedial Techniques in Basic School Subjects. The program which Fernald developed at the Clinic School was actually a learning-disability program, one of the first established in the United States (Gearheart, 1977).

Another prominent figure in the early days of learning-disability research was Dr. Alfred Strauss, a German neuropsychiatrist. According to Johnson and Morasky (1980), Strauss and Heinz Werner, a German psychologist, left Germany in the early 1940's, and came to the United States. In Germany, Struass had worked on the reeducation of brain-injured war veterans. Upon coming to the United States, he and Werner began work with brain-injured children, attempting to isolate their behavior characteristics. They worked mainly with children who were not severely handicapped and who also had an opportunity to receive remediation and rehabilitation. Their research soon led them to notice that differences could be seen between children with brain damage due to inherited/genetic factors (endogenous brain damage) and children with brain damage due to other factors (exogenous brain damage). They also noted

> Disorders of perception including figure-ground confusion, perseveration or difficulty in shifting to a different behavior once another behavior has been initiated, inability to organize and deal with abstract concepts in a normal manner, and some specific problem behaviors such as uninhibited over-active (hyperkinetic) behavior (Johnson and Morasky, 1980, p. 10).

Strauss teamed with Dr. Laura Lehtinen Rogan in working on the remediation of shool-age children with learning problems. In 1947, Strauss and Lehtinen founded the Cove Schools for Brain-Injured Children, and also published their book Psychopathology and the Education of the Child, a book which was still widely used in the 1970's (Gearheart, 1977).

The time period from approximately 1940-1963 was considered a transition period for the field of learning-disabilities. During this time, much effort was put into utilizing the previously existing theories into remedial practice. Psychologists and educators became more involved with learning-disabilities during this period, however, few considered themselves to be learning-disabilities specialists, as the "field" of learning-disabilities was not yet in existence (Meyers and Hammill, 1976).

Many tests and training programs were also developed during this time, utilized initially in clinics, institutions, private schools, and eventually public schools as well. Some of these tests and programs included the Auditory Discrimination Test by Wepman, the Illinois Test of Psycholinguistic Abilities by Kirk and McCarthy, and the Developmental Test of Visual Perception and Developmental Program of Visual Perception by Frostig. Also during this period, Getman and Barsch developed activities for visual-motor skill training in children, while Kephart and Delacato designed activities for training in motor development (Meyers and Hammill, 1976).

In 1962, Kirk developed his term learning-disabilities, as well as a definition to accompany it, displaying both in a college textbook which dealt with special education. Simultaneously, parental groups began to apply pressure for more action and a better definition concerning learning-disabilities, resulting in some states enacting legislation concerning children classified as learning-disabled. In 1963, a group of concerned parents sponsored a conference which was designed to look at the difficulties facing the perceptually handicapped. Also of concern at this conference was the lack of a solid definition "of the problems involved and the resulting difficulty in organizing a homogeneous, recognizable group to foster support for training and treatment programs" (Johnson and Morasky, 1980, p. 12). Samuel Kirk was invited to speak at this conference, and he publicly introduced and discussed his term learning-disabilities. Kirk was well accepted, as was his term and the proposed definition which accompanied it. The conference and Kirk's lecture resulted in the formation of the Association of Children with Learning-Disabilities that very evening (Johnson and Morasky, 1980).

Some of the events which have taken place in the field of learning-disabilities since 1963 include the formation of the Division for Children with Learning-Disabilities within the Council for Exceptional Children in 1968; the funding of Child Service Demonstration Projects by the Bureau of Education of the Handicapped, projects which served as models for instructional services to learning-disabled children beginning in 1971; and the development of the Leadership Training Institute in Learning Disabilities from 1971-1975 (Meyers and Hammill, 1976). The institution of The Education for All Handicapped Children Act of 1975 (P.L. 94-142) also helped advance the field of learning-disabilities by offering a viable definition of the term, as well as guidelines for educational services to be afforded to the child classified as learning-disabled.

Definition of Learning-Disability

The term learning-disability is a difficult one to define, as many different definitions have been suggested and utilized since the inception of the term into general practice. In 1975, Vaughan and Hodges (1975) conducted a study "to determine whether special education personnel groups could begin to agree upon a definition of learning-disabilities" (p. 658). One-hundred persons were asked to rank 10 definitions in order of acceptance as a working definition of learning-disabilities, and were divided into the following subgroups: special education teachers, speech clinicians, directors, nurses, social workers, and psychologists. Eighty-seven persons responded, and although there was some variety in rank order within and among the subgroups, the following definition by Baer received the number one ranking when looking at the population as a whole:

> A child with a learning disability is any child who demonstrates a significant discrepancy in acquiring the academic and social skills in accordance with his assessed capacity to obtain these skills. In general, these discrepancies are associated with specific disabilities such as: gross motor, visual memory, visual discrimination, and other language related disabilities (Vaughan and Hodges, 1975, p. 70).

By comparison, The Education for All Handicapped Children Act of 1975 (P.L. 94-142) suggested a definition very similar to that offered by The Education of the Handicapped Act, an act which P.L. 94-142 was written to amend. The P.L. 94-142 definition is widely utilized throughout the United States, and is stated as follows:

> The term "children with specific learning disabilities" means those children who have a disorder in one or more of the basic psychological processes involved in under-

> standing or in using language, spoken or written, which disorder may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Such disorders include such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. Such term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, or of environmental, cultural or economic disadvantage (1975, 89 STAT. 794).

The definitions offered by Vaughan and Hodges (1975) and P.L. 94-142 (1975) were similar in that they discussed deficiencies which were specific to academic achievement. The P.L. 94-142 definition was more specific in its inclusion and exclusion of certain disorders, as well as in discussing where those disabilities were manifested. Since The Education for All Handicapped Children Act of 1975 was federal legislation which was to be a guideline for all programs dealing with the handicapped, it needed to be very specific in nature so as to leave no room for questions concerning who should be classified as learning-disabled.

Dr. A. Jean Ayres: Sensory Integrative Theory

The perceptual-motor theory of Dr. Ayres, an occupational therapist, was chosen for review as it was the basis behind the Southern California Perceptual-Motor Tests utilized in this study. It was determined by the researcher that an in-depth look at this theory would afford the reader a better understanding of the concepts assessed by the Southern California Perceptual-Motor Tests.

The Ayres concept of sensory integrative therapy differed from other conventional approaches toward remediating learning disorders in that it did not concern itself with the teaching of specific skills. It instead dealt with the brain and its ability to learn how to perform those specific skills (Ayres, 1972a). According to Ayres (1972a):

> If the brain develops the capacity to perceive, remember, and motor plan, the ability can then be applied toward mastery on all academic and other tasks. The objective is modification of the neurological dysfunction interfering with learning rather than attacking the symptoms of that dysfunction (p. 2).

Ayres (1972a) discussed the sensory integrative concept as a therapy type of approach, defining therapy as "any intervention with an intent to remediate given by the educator, psychologist, speech pathologist, physical or occupational therapist, or other professional person" (p. 2). She considered therapy not as a replacement for, but rather a supplement to, the regular classroom instruction or tutoring the child receives. This supplemental aid only serves to benefit the child, as it attempts to decrease/remediate the present dysfunction or problem, thereby increasing the child's ability to learn at a more rapid pace (Ayres, 1972a).

Ayres did not claim that "sensory integrative therapy eliminates the underlying causes of inadequate neural organization and resultant learning disorder" (Ayres, 1972a). The sensory integrative approach merely dealt with lessening the severity of the problems associated with learning disorders--problems which were usually idiopathic in nature and which directly interfered with the learning process (Ayres, 1972a).

The sensory integrative theory incorporated the concept that it is the role of the central nervous system, specifically the brain, to absorb, interpret, organize, and integrate the sensory information with which it is presented. Ayres (1972a) cited the work of Charles Sherrington (1906, 1955), a well-known neurophysiologist, who "stressed the importance of central nervous system mechanisms for sensory information. His work serves as the source for many of the basic theoretical concepts....upon which other theorists have built" (p. 25).

Ayres (1963, 1966a, 1966b, 1971, 1972c) completed much research concerning the perceptual-motor and sensory-integrative difficulties of children, looking at the performance of non-handicapped children, as well as that of children with learning and behavior disorders. Her research has led to the development of the Southern California Sensory Integration Tests (SCSIT), a test battery comprised of 17 subtests "designed to detect and determine the nature of sensory integrative dysfunction" (Ayres, 1980, p. x), and of which the Southern California Perceptual-Motor Tests utilized in the present study are a subcomponent.

The Integrative Process

As defined by Ayres (1972a), integration is "the interaction and coordination of two or more functions or processes in a manner which enhances the adaptiveness of the brain's response" (pp. 25-26). As previously stated, integration of sensory information occurs constantly, as the brain receives, organizes, and interprets the information with which it is presented. The results of this integration of information may be seen in the actions of the child, both intellectually and motorically. One of the major areas of the brain for integrating sensory information concerning movement/motion is the motor cortex. However, sensory integration concerning movement/motion is not limited to this area, rather, it occurs at all levels of the nervous system. It has been proposed that movement experiences which are organized at one level of the brain tend to organize sensory integration at that level as well. Sensory integration which takes place in the brain stem level was said to be facilitated by the use of motor patterns whose integrating centers may also be located in that area (Ayres, 1972a).

Evaluation of Sensory Integrative Dysfunction

In order to recognize sensory integrative dysfunction, the evaluator, or therapist, must have a good comprehension of the characteristics of both normal and abnormal behaviors. The use of a standardized test which has been developed and normed on children assists the therapist in recognizing certain deficits. However, not all levels and signs of sensory integrative dysfunction are readily observable through the utilization of such standardized tests. In such instances, clinical observational techniques may be utilized to assess the child. Ayres (1972a) identified seven areas of importance which should be specifically observed when using these structured observational techniques: primitive postural reflexes, cocontraction of antagonistic muscles, muscle tone, extraocular muscle control, assessment of the vestibular system control, integration of function of the two sides of the body and choreoathetoid movements.

Primitive Postural Reflexes

In the discussion of children with learning disorders, the mechanisms of primitive postural reflexes are considered an important area of assessment. The therapist should concern him/herself with the elicitation of the tonic neck and tonic labyrinthine reflexes. While these reflexes are normally present in young infants, they should be gradually integrated into the sensorimotor system as the child matures chronologically and physically, thereby not allowing interference from these reflexes during maturation of postural mechanisms. If the abnormal presence of these two reflexes occurs simultaneously with certain other signs, it is considered a definite indicator of poor sensory integration which is also associated with learning disorders (Ayres, 1972a).

Cocontraction of Antagonistic Muscles

Ayres (1972a) noted that many children who exhibit learning disorders often display difficulty in contracting antagonistic muscles simultaneously, resulting in the inability to immobilize one or more joints at a given time. This difficulty is especially noted to exist in children with learning disorders who display inadequate postural mechanisms (including poor standing balance). "It is reasoned that a similar type of neuromuscular response is involved in both postural reflexes and cocontraction of muscles, possibly through the secondary afferents of the muscle spindle" (Ayres, 1972a, p. 107).

Muscle Tone

It is important for the therapist to note the muscle tone of the child with whom he/she is working, as well as the variations in tone which may occur. The degree of muscle tone shows the amount of neural impulses reaching the intrafusal motor neurons which service the muscle spindle, thereby determining the amount and type of discharge occuring from the alpha motor neurons. The proprioceptive input received by the central nervous system is in turn determined by the spindle discharge. "It has been hypothesized that proprioceptive flow from the musculature contributes to organization at the brain stem level and to visual perception and other products of sensory integration" (Ayres, 1972a, p. 109).

Ayres (1972a) also noted that certain conditions pertaining to the processing and directing of afferent input by the brain stem may also be shown by the muscle tone of the child. "Similarly, hypotonicity may indicate a paucity of sensory flow upon which normal execution of postural reflexes is dependent" (p. 9).

Extraocular Muscle Control

Also considered skeletal muscles, the role of the extraocular muscles should be understood by the evaluator/therapist. When testing the child, the head should be stabilized, and an object should be moved in various directions in front of the child. The therapist should watch the child's eyes move to follow the moving object in a smooth, coordinated manner. The above method should be considered a minimal evaluation, with other methods available to the therapist (Ayres, 1972a).

According to Ayres (1972a), most methods suggested for the evaluation of extraocular muscle control were not designed to test those muscles per se. Rather, they were "designed to be indices of central nervous system integration and its neural relation to the muscle" (p. 110).

Assessment of Vestibular System Function

The methods utilized to assess vestibular processes are merely suggested correlates of these processes, and most "rely on the contribution of the vestibular system to eliciting the equilibrium reactions that help maintain balance, especially on one foot and usually with eyes closed in order to eliminate the effect of the optical righting reflex" (Ayres, 1972a, p. 110).

No concrete methods of assessment for this system have been established, due to a lack of knowledge concerning all of the functions of this system, as well as the amount of variation which learning-disabled children display concerning their processing of vestibular sensory input. In some children, there is a deficiency in the amount of vestibular input which is received and processed by the child, while in others, there is an overabundance of stimuli, and the child is unable to organize and process it (Ayres, 1972a).

Integration of Function of the Two Sides of the Body

It is difficult to assess this sensorimotor dysfunction when utilizing a standardized test, due to the following factors: this type of dysfunction is extremely subtle; it tends to be more of a tendency than an inability on the part of the child; and it can be willingly overcome by the child. Therefore, structured observations without being obvious to the child, are recommended (Ayres, 1972a).

> One of the procedures for evaluating this behavioral phenomenon is the degree to which a child crosses the mid-line of the body with one hand to engage in activity with the other.... The child who has a tendency to want to use one hand only and that hand only on the ipsilateral side is probably showing a deficiency in crossing the mid-line of the body (Ayres, 1972a, pp. 111-112).

Choreoathetoid Movements

Choreoathetoid movements (sudden, slight, jerky movements/muscle contractions which occur irregularly and arhythmically, and are relatively short in nature) displayed by some children with learning-disabilities are considered involuntary in nature, moreso than they are considered the result of clumsiness due to poor motor planning or immature postural reflexes. This type of motor incoordination is often not obvious where they are required to hold a given posture (Ayres, 1972a).

According to Ayres (1972a), a version of Schilder's arm extension test will probably best elicit choreoathetoid movements where:

> The child is asked to hold arms outstretched, fingers abducted, eyes closed and to count (or if he cannot, to count with the examiner) aloud up to ten. The counting directs attention away from the upper extremities and allows the involuntary motion to occur. It is most apt to occur in the fingers, but the arms may manifest it as well" (p. 112).

Dr. Ayres stressed the sensory integrative concept as an approach for remediating learning disorders. She utilized her theory as the basis for her Southern California Sensory Integration Tests, of which the Southern California Perceptual-Motor Tests are a part. Ayres theory was concerned with the ability of the educator to teach the skills in a certain manner. Although this theory differed from other conventional approaches toward dealing with learning disorders, it has been considered a feasible and workable approach to the remediation of such difficulties in children.

Perceptual-Motor Ability and Learning-Disabilities

The relationship between the perceptual-motor ability of children and learning-disabilities has been widely researched. Quite often this research has also been focused specifically upon the perceptual-motor performance of the child classified as learning-disabled versus that of the non-handicapped child.

Bruininks and Bruininks (1977) conducted a study which compared the motor proficiency of 55 learning-disabled and 55 nondisabled students who ranged in age from six to 13 years, the mean age being 9.3 years. The results of this study showed significant differences in performance on gross motor and fine motor skills between the two groups, with the learning-disabled group performing significantly lower than the nondisabled group. Specifically, differences were noted in the areas concerning body equilibrium, controlled fine visual-motor movements, and bilateral coordination movements utilizing different body parts. "All of these areas include complex motor patterns that require the integration of visual and kinesthetic senses with motor responses" (Bruininks and Bruininks, 1977, p. 1131).

Pyfer and Carlson (1972) conducted a study "to determine whether children classified as learning disabled also demonstrated specific or general motoric dysfunction characteristics which can be identified early" (p. 291). All 28 subjects utilized in this project were between the ages of 5.1 and 13.6 years, and all had been referred to the University of Kansas Perceptual Motor Clinic. The testing instrument utilized in this study was the Lincoln-Oseretsky Motor Development Scale. The results of this project supported Ayres' theory that children who demonstrate perceptual-motor dysfunction display static balance problems as well (Pyfer and Carlson, 1972).

Skubic and Anderson (1970) conducted a study which investigated the perceptual-motor achievement, academic achievement and intelligence of 86 fourth grade boys and girls. All subjects were of normal intelligence, and were divided into a low achiever (41 subjects) or a high achiever (45 subjects) group, based upon their scores on the Stanford Achievement Test (SAT). A perceptual-motor test battery and the California Test of Mental Maturity (CTMM) were administered to all subjects.

The resulting scores on the perceptual-motor test battery significantly correlated with the results of the SAT and CTMM for all children. Specifically,

> The combined group of male and female high achievers performed significantly better than the low achiever group on all subtests of the CTMM, including IQ. They also scored

significantly better on six of the 11 perceptual-motor tests. On the remaining five tests, no differences were noted" (Skubic and Anderson, 1970, p. 33).

Singer and Brunk (1967) administered the Figure Reproduction Test, which consisted of a series of perceptual-motor tasks, as well as the Pinter Test and Stanford Achievement Test, both of which were tests of intellectual ability, to 48 third grade and 43 fourth grade children. All subjects attended the same elementary school and were typically from upper middle class families. Results of this study showed low positive and significant relationships between the intellectual ability tests and the perceptual-motor test, however, "a general appraisal of the data indicates specificity of abilities" (Singer and Brunk, 1970, p. 967).

Chapman and Wedell (1972) completed research which compared the perceptual-motor performance of children who displayed consistent reversal errors in handwriting to children who did not display such errors. Seventy-six boys and 75 girls between the ages of 7.5 years and 8.5 years were tested (mean age = 7.11 years). All children were located in three urban schools which contained the normal socioeconomic range, although there was less representation of the upper levels. A group of perceptual-motor measures was given to both groups, and included the following: (1) visual and perceptual tasks--(a) Developmental Test of Visual Perception (Frostig, 1964), and (b) visual discrimination and orientation utilizing the Standard Reading Tests (Daniels, 1960); (2) orientation in space--(a) right-left discrimination (Benton, 1959), (b) angels in the snow (Kephart, 1960), and (c) crossing the midline (Kephart, 1960); (3) lateral preference--(a) Harris Lateral Dominance Tests (Harris, 1958); and (4) educational attainment--(a) Burt Graded Word Reading Tests, (b) Schnoll Graded Word Spelling

Test, (c) repetition of writing tasks, and (d) copy-writing tasks. The results of this study showed the group containing the reversal-error children performed significantly lower than the nonreversal group on only a few of the measures, indicating that certain specific areas of perceptual-motor skill may affect handwriting achievement (Chapman and Wedell, 1972).

Information-Processing and Motor Performance

The term information-processing is one which may be discussed synonymously with the term perceptual-motor. Both describe the process involved in the performance of a motor skill or task. The following section has described information-processing and its relationship to motor performance.

There are certain processes which must occur during the performance of a motor skill. Successive stages are responsible for the processing of information prior to the resulting motor response. Various names have been utilized to identify these stages, depending upon the information-processing model utilized. Regardless of the name attached, the basic function of each of these stages is similar for each model (Corbin, 1980).

In discussing what he termed the information-processing model, Kerr (1982) identified the following as major components: (1) input (bits of sensory information), (2) perception (identification/integration), (3) decision (selection), (4) effector (control), and (5) output (movement). Two of the major functions of such processing models, as identified by Kerr (1982) included: (1) identification of the main components in processing and the illustration of the overall structure of the system, and (2) an attempt to "derive the various control processes governed or shared by these structural components" (p. 39).

Williams, Temple, and Bateman (1978), in discussing theories of learning, stated that these theories have

> For some time suggested that to learn or perform either perceptual-motor or cognitive tasks beyond minimum levels of mastery the individual must be able to attend to and process sensory information, singly or in various combinations, from a variety of sources (p. 472).

The ability of the individual to perform such tasks with high consistency and efficiency is also important. If the ability of the individual to process the information and the processing demands of the task are compatible, the learning of the task is more efficient (Williams, et al, 1978).

Information-Processing in Children

According to Connolly (1970), children exhibit poor motor performance as compared with adults because they are too slow to perform certain tasks, not because they are unable to perform the necessary movements. Specifically, "they are unable to adequately or rapidly integrate the necessary sequence of subskills which go to make up such activities" (Connolly, 1970, p. 161). As the child gets older, he/she is able to process such information in a faster, more complex manner. "Equally important, children gradually acquire the capacity to process complex multiple sources of sensory information as effectively as simple, single input" (Williams, et al., 1978, p. 472). In normal children, these suggested changes in the information-processing system take place between the ages of five to ten years (Williams, et al., 1978).

Kay (1970) suggested that the child's performance in motor responses must be considered from a child's point of view. When considered in terms of the known world of the adult, difficulties may not be apparent. Simply explained, due to a lack of experience, it is necessary for the child to consider more possibilities prior to a response, and therefore he/she must process more information. The adult has past experiences in similar situations to call upon for information, and is therefore able to respond without having to process extra information concerning every possible outcome regarding a response to the situation.

Connolly (1970) conducted an experiment which analysed the information processing of children of different ages. He utilized a modification of the card-sorting technique of Crossman (1953), which he felt children of various ages would be able to perform without becoming bored. A total of 60 subjects, 30 male and 30 female, were utilized in this study. Subjects were between the ages of 5 years and 10 months, and 30 years and 11 months, and were divided into six age groups, with 10 subjects in each: (1) six-year-olds, (2) eight-year-olds, (3) ten-year-olds, (4) twelve-year-olds, (5) fourteen-year-olds, and (6) adult. Results of this experiment showed that the amount of time necessary to complete the designated sorting procedure decreased significantly as age increased, and increased significantly as entropy increased as well. There was also a significant age by information load interaction, indicating that "the slope of the line relating decision time to information differs between groups" (Connolly, 1970, p. 173). Specifically, a substantial increase was noted in the decision time of the youngest group of children as the information load was increased. Also noted from the data collected was that "information-transmission rates, measured as the rate of gain of information, increase steadily with age and continue beyond the 14-year level" (Connolly, 1970,

p. 173). Movement times for each of the age groups were also examined. The children were able to distribute the cards between eight different locations as quickly as when there were only two locations when the information load was considered to be zero, in other words, the response was entirely pre-programmed (Connolly, 1980).

> This observation reinforces the view that the information-processing abilities are an important limiting factor on the sequencing of the sub-units which go to make up basic motor skills. A further interesting feature about the movement time data is the relationship between speed of movement and age, the younger the child the slower the movement even when it is pre-programmed (Connolly, 1970, p. 173).

Task Complexity

Kerr (1982) defined task complexity as "the demands the task places on memory and the information processing capacity: the number of bits of information" (p. 314). Billings (1980) discussed the importance of skill progressions as the means of teaching motor tasks. He believed that identifying those factors which contributed to the difficulty or complexity of a task allowed for the construction of a base for the logical learning of the task.

> Often analysis of the movements of a skill have been the sole basis for suggesting levels of difficulty. By identifying the perceptual, decision making, motor act and feedback characteristics inherent in a given skill, the teacher-researcher obtains an enhanced appreciation for task complexity (Billings, 1980, p. 18).

Many terms have been utilized to describe the basic features of motor behavior. Regardless of the terms utilized, it appeared that all agreed on "the importance of perceptual awareness of the act to be performed, a decision as how to act, the production of the motor act, and the necessity of feedback information" (Billings, 1980, p. 19). All four of these components are involved in motor performance, and by examining the level of complexity of each, one can identify the level of difficulty of the skill to be performed. Many times, the production of the motor act itself is the only component of the four utilized to determine the complexity of the task. An examination of all four phases is necessary for determination of total task complexity, as well as skill sequencing (Billings, 1980).

Perceptual Complexity

Many factors can increase or decrease the perceptual complexity of a task. According to Billings (1980), these factors include:

> (1) the number of stimuli which must be attended to, (2) the number of stimuli present, (3) the speed or duration of the stimuli, (4) the intensity of the stimuli, and (5) the extent to which the stimuli are conflicting or confusing" (p. 19).

Complexity of a task, therefore, is affected by the perceptual requirements of the specific task. Any changes in these requirements will cause an increase or decrease in the total difficulty of the task (Billings, 1980).

Decision Making Complexity

Once the perceptual information has been received by the individual, he/she must interpret it, compare it to information from previous experiences, and decide upon an appropriate response. The difficulty in making a decision increases as a function of the number of decisions to be made, the number of alternatives available per decision, and the speed required to make the decision. "Additional difficulty is imposed if decisions must be made in a particular sequence, if one decision effects the alternatives available in later decisions, or if extensive memory comparisons must be made" (Billings, 1980, p. 21).

Motor Act Complexity

Once a decision as to how to act has been made, motor commands are utilized to produce the muscular response necessary to perform the task. An appraisal of the motor performance of the individual is an obvious way to determine the complexity of the task. The more different the joint and muscle actions involved, the greater the difficulty of the task. The greater the necessity of coordination of actions and/or speed and accuracy in performance, the greater the task difficulty. However, an appraisal of this component alone should not be utilized by itself to determine total task complexity (Billings, 1980).

Feedback Complexity

Once the motor response has been initiated, the feedback to the individual begins. This feedback allows the individual to determine the success of his/her response. This feedback is important in continuous acts, as it may be necessary to alter the response if it is in error. It is also important in evaluating the performance of short-term tasks or acts which have already been completed. The amount of feedback available to the performer is also important, as it enables him/her to make a proper judgement concerning his/her performance. In some situations where the amount of feedback is hampered, such as restricted visual feedback by the individual him/herself when performing a gymnastic stunt, "feedback in the form of teacher verbalizations or video tape replays may provide additional information for altering the motor response. The absence of such information increases the difficulty of interpreting feedback and thus of mastering the act" (Billings, 1980, p. 22). In general, the larger the number of senses involved in the interpretation of feedback, the greater the amount of learning (Billings, 1980).

Just as the quality and accuracy of feedback is important for proper performance of a task, conflicting feedback can hamper performance, making interpretation of feedback difficult. For example, "inconsistency between knowledge of results and knowledge of performance (the ball goes in the basket but the technique was incorrect) can make interpretation of the feedback more difficult" (Billings, 1980, p. 22).

Total Task Complexity

According to Billings (1980), the four components of motor behavior previously discussed can all vary in the amount of complexity involved in the performance of a task, however, they are not to be considered independent of one another. It is possible for a task to be complex in some aspects--perhaps perception and decision making--yet simple in other aspects--the motor response for example--as in a move in the game of chess. A task may also be complex in the production of the motor act itself, as in a twisting somersault, and at the same time require little perceptual and decision-making complexity.

> The complexity of any motor performance may be systematically increased by adjusting the complexity of any component. This systematic increasing of complexity provides an obvious format for constructing appropriate learning progressions" (Billings, 1980, p. 23).

By analyzing the complexity of the individual components of a motor act or task, the teacher is able to identify factors involved in contributing to task difficulty. Identification of such factors may be utilized to develop research and progressions, as well as identity difficulties in the performance of individual students. Such identification may also allow for the adjustment of activities for special populations, including the sensory deficient, intellectually handicapped, and motor impaired (Billings, 1980).

Learning-Disabilities and Physical Education

Studies previously mentioned in this chapter by Bruininks and Bruininks (1977), Pyfer and Carlson (1972), Skubic and Anderson (1970), Singer and Brunk (1967), and Chapman and Wedell (1972) have shown the relationship between perceptual-motor ability and the child classified as learning-disabled. Accordingly, improvements in the perceptual-motor performance of children takes place in the physical education classroom. Children classified as learning-disabled often display significant deficits in perceptual-motor performance which require specific training and remediation. Physical education has become an integral part of this training and remediation. According to Dauer and Pangrazi (1975),

> Perceptual-motor programs are important additions to the instructional strategies and content of regular physical education programs. A variety of movement demands and challenges should be included in the regular physical education classes. Value lies both in the precise, limited movements and the exploratory, creative approach inherent in the movement education method. And there is a wide range of movement combination between the two extremes (p. 5).

Established perceptual-motor programs are mainly concerned with the correction of perceptual-motor deficits and the remediation of learning difficulties which are attributed to lags or breakdowns in the perceptual-motor development of the child. Growth and development of children occurs in a cephalocaudal and proximodistal fashion. Disruptions, lags, or omissions in this process cause certain perceptual-motor bases to develop incorrectly, thereby disturbing the integrative process (input, integration, response) important to complex learning (Dauer and Pangrazi, 1975).

Dauer and Pangrazi (1975) defined a normal perceptual reaction as "a meaningful and consistent response to the input stimuli, which connotes efficiency of process" (p. 5). In the physical education classroom, the ability of the child to perform simple motor tasks skillfully and accurately denotes a normal perceptual-motor reaction. The inability to perform such tasks, coupled with motor-coordination difficulties (particularly those concerning coordination, balance and postural control, image of the body and its parts, and time and space relationships), is often found in the child with learning difficulties. Poor coordination and poor motor planning are common characteristics of such children (Dauer and Pangrazi, 1975).

Remediation of perceptual-motor difficulties may occur in a variety of settings: through a specific perceptual-motor program, through compensatory physical education, through adapted physical education, and through the general physical education program. While most perceptual-motor programs occur outside of the school setting, the concepts involved in compensatory physical education may be easily incorporated into the general physical education program (Humphrey, 1976). Compensatory physical education attempts to achieve the same results as an organized perceptual-motor program, the main difference being that "compensatory physical education tends to provide a way of improving learning ability which is free from uninteresting systematic activities. This is to say that physical experiences are likely to be more motivational and enjoyable" (Humphrey, 1976, p. 70). Specifically defined,

> Compensatory physical education attempts to correct various types of child learning disabilities which may stem from an impairment of the central nervous system and/or have their roots in certain social or emotional problems of children. This branch of physical education, most often through the medium of perceptual-motor development, involves the correction, or at least some degree of improvement, of certain motor deficiencies, especially those associated with fine coordination (Humphrey, 1976, pp. 7-8).

Sherrill (1981) discussed the relationship between perceptual-motor training and physical education--specifically through adapted physical education. Perceptual-motor training is considered to be an important aspect of the adapted physical education program. Adapted physical educators should be proficient in diagnosing, evaluating, and remediating perceptual-motor difficulties in children, whether they be classified as learning-disabled or non-handicapped. Specifically defined, adapted physical education is:

> A comprehensive service delivery system designed to identify and ameliorate problems within the psychomotor domain. Services include psychomotor assessment, individualized educational programming, developmental and/or prescriptive teaching, counseling, and coordination of related resources/services so as to provide optimal physical education experiences for all children and youth....serves both special education students and so-called normal pupils with psychomotor or health problems. It may occur in the mainstream, in a separate setting, or in some combination of these two placement extremes (Sherrill, 1981, p. 10).

Perceptual-motor training may take place simultaneously in the academic classroom and the adapted physical education setting. Sherrill (1981) stated, however, that "Perceptual-motor training in adapted physical education should not duplicate that in the classroom. The objectives may be identical, but the activities differ" (p. 266). Sherrill offered eye, hand, and eye-hand movement which teach concepts concerning space as an example. In the classroom situation, the child may draw, trace, connect dots or cut out shapes, whereas activities utilized in the adapted physical education setting which accomplish the same objectives may involve purposeful movement of the entire body, or making shapes with the body, either individually or in partners or groups (Sherrill, 1981).

It is the responsibility of the physical educator to provide appropriate opportunities which lead to the development and/or remediation of perceptual-motor skills and/or deficits in children classified as learning-disabled. This training may occur in the general, adapted, or special physical education classroom, or any combination of the three, depending upon the specific needs of the child. Hunter (1971), in discussing the implications of perceptual-motor programs for physical education, stated:

> Motor activities may help some students, but they are not a cure-all for perceptual deficits. Nevertheless, knowledge based on programs that are intelligently implemented can make an important contribution to the intellectual, social, and emotional growth of a learner. Our new focus on and alertness to perceptual-motor dimensions afford new insights into the learning process, and movement experiences which improve the perceptual-motor capacities should play an increasingly important role in education (p. 126).

Federal Legislation Pertaining to Learning-Disabilities

Although much federal legislation has been enacted concerning the education of the handicapped, two federal laws: Public Law 94-142, The Education of All Handicapped Children Act of 1975, and Section 504 of the Rehabilitation Act of 1973, have had the most significant impact and affect on the education of handicapped children. Along with the enactment of those two laws, a better understanding of the following concepts has developed: free appropriate public education, individualized and appropriate education, and least restrictive environment (Turnbull and Turnbull, 1978). This section has concerned itself with these three concepts as specifically identified in Public Law 94-142.

According to P.L. 94-142, a child classified as learning-disabled is entitled to a free, appropriate public education. Specifically,

> (18) The term 'free appropriate public education' means special education and related services which (A) have been provided at public expense, under public supervision and direction, and without charge, (B) meet the standards of the State educational agency, (C) include an appropriate preschool, elementary, or secondary school education in the State involved, and (D) are provided in conformity with the individualized education program required under section 614(a)(5) (1975, 89 STAT. 775).

In essence, the child classified as learning-disabled must be afforded a public education which is appropriate to his/her needs, at no expense to the child or his/her parents/guardians. Physical education has been identified as a direct service under the definition of special education given in P.L. 94-142, and is therefore considered part of the free, appropriate public education required by law.

Concerning the statement 'individualized and appropriate education', Public Law 94-142 stated:

> (19) The term 'individualized education program' means a written statement for each handicapped child developed in any meeting by a representative of the local educational agency or an intermediate educational unit who shall be qualified to provide, or supervise the provision of, specially designed instruction to meet the unique needs of handicapped children, the teacher, the parents or guardian of such child, and, whenever appropriate, such child, which statement shall include (A) a statement of the present levels of educational performance of such child, (B) a statement of annual goals, including short-term instructional objectives, (C) a statement of the specific educational services to be provided to such child, and the extent to which such child will be able to participate in regular educational programs, (D) the projected date for initiation and anticipated duration of such services, and (E) appropriate objective criteria and evaluation procedures and schedules for determining, on at least an annual basis, whether instructional objectives are being achieved (1975, 89 STAT. 776).

In physical education, individual goals and objectives should be determined for the child classified as learning-disabled, and an individual physical education plan should be written for the child, following the guidelines identified earlier.

The least restrictive environment concept has been stated in P.L. 94-142 as follows:

> To the maximum extent appropriate, handicapped children, including children in public or private institutions or other care facilities, are educated with children who are not handicapped, and that special classes, separate schooling, or other removal of handicapped children from the regular educational environment occurs only when the nature or severity of the handicap is such that education in regular classes with the use of supplementary aids and services cannot be satisfactorily achieved (1975, 89 STAT. 781).

When considering the least restrictive environment, one must also consider that education of children classified as learning-disabled in the general or regular physical education setting may not afford them the least restrictive environment. They may be able to participate physically, as well as have the mental capacities to participate, however, the perceptual-motor deficits discussed earlier in this chapter may be such that the child cannot participate adequately in the regular physical education classroom. Continued failure may also lead to social and emotional problems for the child. The physical education classroom must be well considered when discussing the least restrictive environment for the child classified as learning-disabled, as it may not always be the most appropriate placement for all such children. Unfortunately, placement in the physical education setting is often overlooked when discussing the placement of the child classified as learning-disabled.

Chapter Summary

Although the term learning-disability is relatively recent, the field of learning-disabilities has existed for many decades. Research by Morgan, Kirk, Fernald, Strauss, Werner, and Lehtinen Rogan have assisted in obtaining pertinent information concerning the child classified as learning-disabled. Public Law 94-142 (1975) has offered a working definition of the term learning-disability, as well as identified the basic right of the child classified as learning-disabled. The perceptual-motor theory of Ayres has offered new insights and understanding of the deficits in perceptual-motor performance seen in the learning-disabled child, as did the research by Bruininks and Bruininks (1977), Pyfer and Carlson (1972), Skubic and Anderson (1970), Singer and Brunk (1967), and Chapman and Wedell (1972). The Ayres theory also offered information concerning the concept behind the formation of the Southern California Sensory Integration Tests, of which the Southern California Perceptual-Motor Tests utilized in this study are a part. The implications of physical education on the perceptual-motor performance of the child classified as learning-disabled is an area of research which has been touched upon, but definitely requires much more attention. The concepts discussed by Humphrey (1976) and Sherrill (1981) offered a solid base from which the physical educator may build, however, much more research concerning the implication of physical education for the child classified as learning-disabled must also be conducted.

This chapter defined the term learning-disability, and identified the specific perceptual-motor theory behind the SCPMT. It also discussed the relationship between perceptual-motor performance and the learning-disabled child, as well as the effect of information-processing on motor skill performance. The implications of physical education for the child classified as learning-disabled were also discussed, and federal legislation pertaining to such children was also identified.

CHAPTER III

METHODS

The purpose of this study was to determine if differences in performance exist among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Southern California Perceptual-Motor Tests (SCPMT) and selected perceptual-motor tasks. A second purpose of this study was to determine if any differences which occur on the SCPMT and selected tasks increase or decrease with age among seven-and eight-year-old children classified as learning-disabled and non-handicapped.

Pilot Study

A pilot study was conducted prior to the start of actual testing to insure the competence of those administering the Southern California Perceptual-Motor Tests and the selected perceptual-motor tasks, as well as those timing, scoring and recording the results. One person was trained to administer the SCPMT, two persons were trained to score the SCPMT, three persons were trained to administer and score the selected tasks, and two persons were trained to time the selected tasks. Each of the four subjects in the pilot study was tested on the SCPMT and the selected tasks in the gyms in Wittich Hall on the University of Wisconsin-La Crosse campus.

Instrumentation

The Southern California Perceptual-Motor Tests and four individual selected perceptual-motor tasks designed by the researcher were chosen for use in this study. Complete descriptions of the test and tasks are included in the following pages.

Southern California Perceptual-Motor Tests

The Southern California Perceptual-Motor Tests (SCPMT) was a test battery made up of eight subtests which have been incorporated into the 17-test battery of the Southern California Sensory Integration Tests (SCSIT). According to Ayres (1980), these tests were developed due to "The need to understand the perceptual-motor and related deficits in children with learning and behavior disorders" (p. x). The following subtests were included in the SCPMT portion of the test battery: Position in Space (PS), Motor Accuracy-Revised (MAC-R), Crossing Midline of Body (CML), Bilateral Motor Coordination (BMC), Right-Left Discrimination (RLD), Standing Balance-Eyes Open (SBO), and Standing Balance-Eyes Closed (SBC). Norms for this test battery included ages 4.0 through 8.11 years on all subtests except PS and MAC-R, both of which had a maximum age of 10.11 years. A test-retest method was utilized by Ayres to determine reliability for all subtests (Appendix A).

Description of Subtests

1. Position in Space. (30 items)

   Child selected a picture or design that matched a stimulus figure; attempted to remember the stimulus figures which were presented for three seconds; and selected a set of figures that matched the stimulus figures (Goodwin & Driscoll, 1980).

2. Motor Accuracy-Revised. (1 item)
Child traced a printed black line design with preferred hand, then non-preferred hand, attempting to finish within time frame determined by the researcher (60 seconds) (Goodwin & Driscoll, 1980).
3. Imitation of Postures. (12 items)
Child attempted to imitate(mirror image) the examiner's posture using arms and hands (child and examiner were seated facing each other) (Goodwin & Driscoll, 1980).
4. Crossing Midline of Body. (8 items, repeated three times)
Child attempted to imitate (mirror image) the examiner's hand movements to the eyes and ears on the same and opposite sides of the body from the hands (child and examiner were seated facing each other) (Goodwin & Driscoll, 1980).
5. Bilateral Motor Coordination. (8 items)
Child attempted to imitate (mirror image) the examiner's pattern and sequence of slapping on the right or left thigh with the same-side hand, or clapping (child and examiner stood facing each other) (Goodwin & Driscoll, 1980).
6. Right-Left Discrimination. (10 items)
Child attempted to follow examiner's commands or to answer examiner's questions involving right-left discrimination (child and examiner were seated facing each other) (Goodwin & Driscoll, 1980).
7. Standing Balance: Eyes Open. (1 item)
With eyes open and without losing balance, child stood on one foot at a time, for as long as possible (up to 180 seconds for each foot) (Goodwin & Driscoll, 1980).

8. Standing Balance: Eyes Closed. (1 item)

With eyes closed and without losing balance, child stood on one foot at a time, for as long as possible (up to 180 seconds for each foot) (Goodwin & Driscoll, 1980).

Selected Perceptual-Motor Tasks

The four perceptual-motor tasks designed by the researcher for use in this study included the following: a Scooter Activity, a Ball Activity, a Hopscotch Activity, and a Beam Activity. Each task was developed based on the following criteria:

a) tasks were to be common movement experiences to which seven-and eight-year-old children are generally exposed;
b) tasks were to be motivational/enjoyable for the subject, so as to insure that the subject would put forth full effort;
c) tasks were to be easily performed by this time in the subject's developmental sequences;
d) tasks were to be easily understood by the subject;
e) tasks were to require a response based on the input (stimulus) the subject received, and the subsequent processing of that information;
f) tasks were to involve large muscle movement;
g) tasks were to be within all safety limitations;
h) tasks were to require minimal space and equipment;
i) tasks were to be novel in nature in that the subject would be performing a common movement experience in a manner unique to him/her;
j) tasks were to require minimal direction and verbal instruction; and
k) task results were to provide an accurate indication of the performance of both those children classified as learning-disabled and non-handicapped on common perceptual-motor skills.

Description of the Selected Perceptual-Motor Tasks

1. Scooter Activity.

   Child was to maneuver him/herself around seven cones set at various distances and angles from each other while remaining on a scooter, as quickly as possible.

2. Hopscotch Activity.

   Child was to hop/jump in and out of 13 hoops set in a specific pattern on the floor as quickly as possible.

3. Ball Activity.

   Child was to continuously bounce a playground ball while moving through a course of six hoops set on the floor at various distances from each other, bouncing the ball once in each hoop, as quickly as possible.

4. Beam Activity.

   Child was to move across an L-shaped beam designed by the researcher, in any manner he/she saw fit, while moving over and under six hurdles set at various heights and distances across the beam, as quickly as possible.

The score for each task was based upon the time it took the child to complete the task, to the nearest .5 second. The child was encouraged to complete the task as quickly as possible as lower times resulted in better scores. Deductions in scores were made for any errors committed by the child throughout the task. Each subject completed the four tasks in a randomized order predetermined prior to the start of testing. The child received two trials for each task, completing all four tasks in the proper order, and then repeating the sequence.

A diagram of each task, as well as the specific directions, score sheet, and listing of errors for each task may be found in Appendix D.

Subject Selection

The subjects utilized in this study were students from the La Crosse School District, located in the following five elementary schools: Harry Spence, Jefferson, Roosevelt, State Road and Summit. All subjects classified as learning-disabled were identified and chosen by the learning-disabilities teachers in each school. The non-handicapped students were subsequently selected by the same teachers, with an attempt made to correlate the ages, sex and schools of the learning-disabled and non-handicapped subjects. A total of 14 seven-year-old and 23 eight-year-old children were chosen, 17 of which were classified as learning-disabled and 20 of which were considered non-handicapped. A further breakdown of the subject groups showed six seven-year-old and 11 eight-year-old children classified as learning-disabled, and eight seven-year-old and 12 eight-year-old non-handicapped children.

Procedures

Following the receipt of permission from the Research and Development Committee of the La Crosse School District (Appendix B), the principals and learning-disabilities teachers of the schools involved were informed of the study by both the Committee Chairperson and the Supervisor of Exceptional Education (Appendix B). The learning-disabilities teachers were asked to identify and choose the learning-disabled sample for the study, and then subsequently select the non-handicapped population as well (Appendix B). A list of learning-disabled and non-handicapped subjects from each school was forwarded to the Supervisor of Exceptional Education, and a letter to the parent and informed consent form were sent to the parents of each subject, directly from the Office of Exceptional Education (Appendix C). Each consent form was to be returned to the Supervisor of Exceptional Education, after which a list of subjects was given to the researcher. The researcher met with each learning-disabilities teacher and arranged for a testing facility within the school, as well as a testing schedule for each child. Each child was tested in his/her own school setting during the regular school day. The following facilities were utilized at each school: Harry Spence-Speech and Language Room/library for SCPMT, kindergarten classroom/cafeteria for tasks; Jefferson-basement storage room for the SCPMT and tasks; Roosevelt-Speech and Language Room for SCPMT, cafeteria for tasks; State Road-Speech and Language Room/Music Room for SCPMT, gymnasium for tasks; and Summit-School Social Worker's Office for SCPMT, gymnasium for tasks. Once consent forms were returned and a list of subjects was secured, testing was begun. All consent forms were not returned promptly, and a second letter to the parent and consent form were sent to those who failed to respond. Parents who failed to respond were contacted by telephone by the learning-disabilities teacher of the corresponding school or the researcher, and verbal permission to test the child was secured, with written permission to follow. As permission was received either through the second letter to the parent or through verbal means, those children were incorporated into the testing schedules already formed, as permission for all subjects was not secured prior to the start of testing, however, no subject was tested without parental consent.

Test Administration

The following procedures were followed for overall test administration: Each subject was tested individually; the SCPMT and the selected tasks were administered to each subject on two separate days in order to break up the amount of time out of the classroom, as well as alleviate any fatigue problem which might have occurred otherwise; the order in which each subject completed the selected tasks was randomly assigned by the University of Wisconsin-La Crosse computer through the use of a $RANDORD program; the order in which each subject completed the SCPMT was done according to the instructions specified by the test itself; and while most subjects were tested on the SCPMT first, then the selected tasks, this was not done intentionally, rather it was based upon availability of facilities and subjects.

Administration Specific to the Selected Tasks

Instructions for each task were given to the child as he/she arrived at that task. The tester explained the task to the child, and the child completed the task immediately thereafter. Once the child completed all four tasks in the specified order, he/she repeated the tasks in the same sequence. A repeat of the instruction for each station was not necessary if the child displayed a good comprehension of what was expected of him/her the first time through. The selected tasks were administered and scored by one person, and timed by a second person. Due to scheduling difficulties, it was necessary to have three different persons administer and score the tasks, and two different persons time the tasks. Those administering the tasks included a graduate and undergraduate student in the Physical Education for the Handicapped Program at the University of Wisconsin-La Crosse, and a former student at UW-La Crosse who holds a degree in Physical Education. Those timing the tasks included a graduate student in the Physical Education for the Handicapped Program at UW-La Crosse (the researcher), and the same student listed above with a degree in Physical Education.

Administration Specific to the SCPMT

The SCPMT was administered according to the directions specifically outlined by the testing manual. The test was administered by the researcher and scored by a second person, both of whom were graduate students in the Physical Education for the Handicapped Program at the University of Wisconsin-La Crosse.

Statistical Procedures

An analysis of variance (ANOVA) procedure was utilized to analyze the data collected in this study. Child classification (LD or NH) was represented on one factor, and age (7 or 8) was the second factor. A two-way ANOVA was completed for the raw scores of each of the eight subtests of the SCPMT, and a three-way ANOVA with repeated measures was completed for each of the four selected perceptual-motor tasks, with the two trials representing the repeated measures. Means and standard deviations were also computed for the SCPMT and selected tasks to display the differences/similarities between each of the groups. Finally, a Scheffe Post Hoc Test was completed for all significant interactions for the subtests and tasks, in order to ascertain specifically where the differences occurred. The .05 level of significance was adopted for all tests of significance. All computations were made utilizing the BMD statistical packages

(Engelman, Frane & Jennrich, 1977) and were carried out at the Academic Computer Center at the University of Wisconsin-La Crosse.

CHAPTER IV

RESULTS AND DISCUSSION

This study was conducted to determine if differences exist in perceptual-motor performance among seven-and eight-year-old children classified as learning-disabled (LD) and non-handicapped (NH). The Southern California Perceptual-Motor Tests (SCPMT) and four selected perceptual-motor tasks, which included a Scooter Activity, a Hopscotch Activity, a Ball Activity, and a Beam Activity, were utilized to test the 37 subjects in this study. The learning-disabled population consisted of six seven-year-olds and 11 eight-year-olds, totalling 17 subjects. The non-handicapped population consisted of eight seven-year-old and 12 eight-year-old children, totalling 20 subjects.

An analysis of variance (ANOVA) procedure was utilized to analyze the data collected in this study. Child classification (LD cr NH) was represented on one factor, and age (7 or 8) was the second factor. A two-way ANOVA was computed for the raw scores of each of the eight subtests of the SCPMT, and a three-way ANOVA with repeated measures was completed for each of the four selected perceptual-motor tasks, with the two trials representing the repeated measures. Means and standard deviations were also computed for the SCPMT and selected tasks to display the differences/similarities between each of the groups. Finally, a Scheffé Post Hoc Test was completed for all significant interactions for the subtests and tasks in order to ascertain specifically where the differences occurred.

Results

Southern California Perceptual-Motor Tasks

The results of the statistical analyses completed for each subtest of the SCPMT have been presented in this chapter in the following order: (1) Position in Space, (2) Motor Accuracy-Revised, (3) Imitation of Postures, (4) Crossing Midline of Body, (5) Bilateral Motor Coordination, (6) Right-Left Discrimination, (7) Standing Balance-Eyes Open, and (8) Standing Balance-Eyes Closed.

Position in Space

The means and standard deviations for the Position in Space subtest are represented in Table 1. The results of the analysis of variance for this subtest are shown in Table 2. A graph of the mean scores for each group is shown in Figure 1.

No significant differences were noted for age, group, or age by group interaction. The F values of 2.26, 3.60, and 3.60 for age, group and age by group interaction, respectively, were less than the 4.15 needed for significance.

Table 1

Position in Space

Means and Standard Deviations

Group	7	8	Total
	16.00[a]	15.54	15.70
LD	2.28[b]	3.30	2.91
	(6)[c]	(11)	(17)
	16.00	19.92	18.35
NH	3.54	3.73	4.07
	(8)	(12)	(20)
	16.00	17.82	17.14
Total			3.78
	(14)	(23)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 2

Position in Space

Analysis of Variance

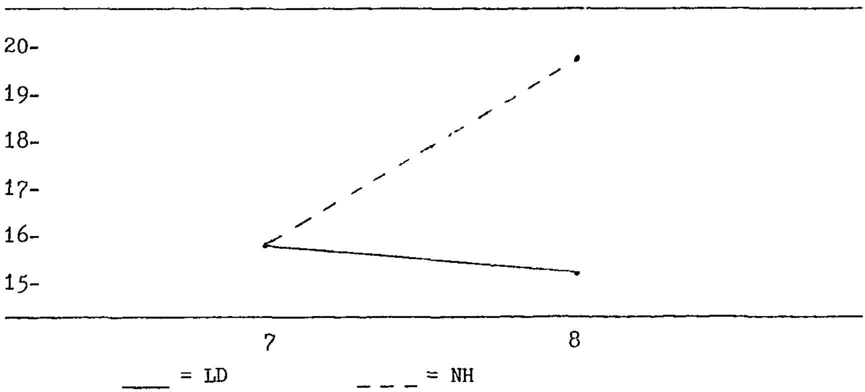
Source	SS	df	MS	F
Age	25.73	1	25.73	2.26
Group	41.01	1	41.01	3.60
Age by Group Interaction	41.01	1	41.01	3.60
Error	375.64	33	11.38	

* = $P < .05$ $F_{(1,33)} = 4.15$

Figure 1

Position in Space

Mean Scores



Motor Accuracy-Revised

Tables 3 and 4 are representative of the means and standard deviations for the Motor Accuracy-Revised subtest. Tables 5 and 6 display the results of the analysis of variance procedure, while a graph of the mean scores for each group is shown in Figures 2 and 3.

The Motor Accuracy-Revised subtest scores were further subdivided into accuracy and adjusted scores for both the right and left hands. The accuracy scores represent the subject's ability to trace a black printed line, while the adjusted scores included not only the motor performance of the subject, but the time required to complete the task as well. No significant differences were noted between ages, between groups, or for age by group interaction for any of the scores identified.

Table 3

Motor Accuracy-Revised

Means and Standard Deviations

Group	RH-ACC. 7	RH-ADJ. 7	RH-ACC. 8	RH-ADJ. 8	RH-ACC. Total	RH-ADJ. Total
	169.08[a]	156.25	168.59	156.57	168.76	156.46
LD	2.40[b]	2.97	3.47	3.61	3.06	3.30
	(6)[c]	(6)	(11)	(11)	(17)	(17)
	170.41	157.01	171.77	160.20	171.22	158.92
NH	4.31	4.21	5.36	3.45	4.90	4.00
	(8)	(8)	(12)	(12)	(20)	(20)
	169.84	156.68	170.25	158.46	170.01	157.79
Total					4.28	3.85
	(14)	(14)	(23)	(23)	(37)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 4

Motor Accuracy-Revised

Means and Standard Deviations

Group	LH-ACC. 7	LH-ADJ. 7	LH-ACC. 8	LH-ADJ. 8	LH-ACC. Total	LH-ADJ. Total
	167.33[a]	157.87	166.64	157.89	166.88	157.88
LD	2.88[b]	7.04	3.19	4.52	3.01	5.32
	(6)[c]	(6)	(11)	(11)	(17)	(17)
	165.31	155.51	167.98	158.91	166.91	157.55
NH	2.54	3.76	3.09	3.58	3.12	3.94
	(8)	(8)	(12)	(12)	(20)	(20)
	166.18	156.52	167.34	158.42	166.90	157.70
Total					3.03	4.56
	(14)	(14)	(23)	(23)	(37)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 5

Motor Accuracy-Revised

Analysis of Variance

Source	SS	df	MS	F
Right-Hand Accuracy Scores				
Age	1.63	1	1.63	0.09
Group	43.52	1	43.52	2.41
Age by Group Interaction	7.40	1	7.40	0.41
Error	595.67	33	18.05	
Right-Hand Adjusted Scores				
Age	26.60	1	26.60	2.05
Group	41.32	1	41.32	3.18
Age by Group Interaction	17.74	1	17.74	1.36
Error	429.20	33	13.00	

* = $P < .05$ $F_{(1,33)} = 4.15$

Table 6

Motor Accuracy-Revised

Analysis of Variance

Source	SS	df	MS	F
Left-Hand Accuracy Scores				
Age	8.33	1	8.33	0.93
Group	0.99	1	0.99	0.11
Age by Group Interaction	24.28	1	24.28	2.73
Error	293.90	33	8.91	
Left-Hand Adjusted Scores				
Age	25.10	1	25.10	1.20
Group	3.78	1	3.78	0.18
Age by Group Interaction	24.52	1	24.52	1.17
Error	692.86	33	21.00	

* = $P < .05$ $F_{(1,33)} = 4.15$

Figure 2

Motor Accuracy-Revised

Mean Scores

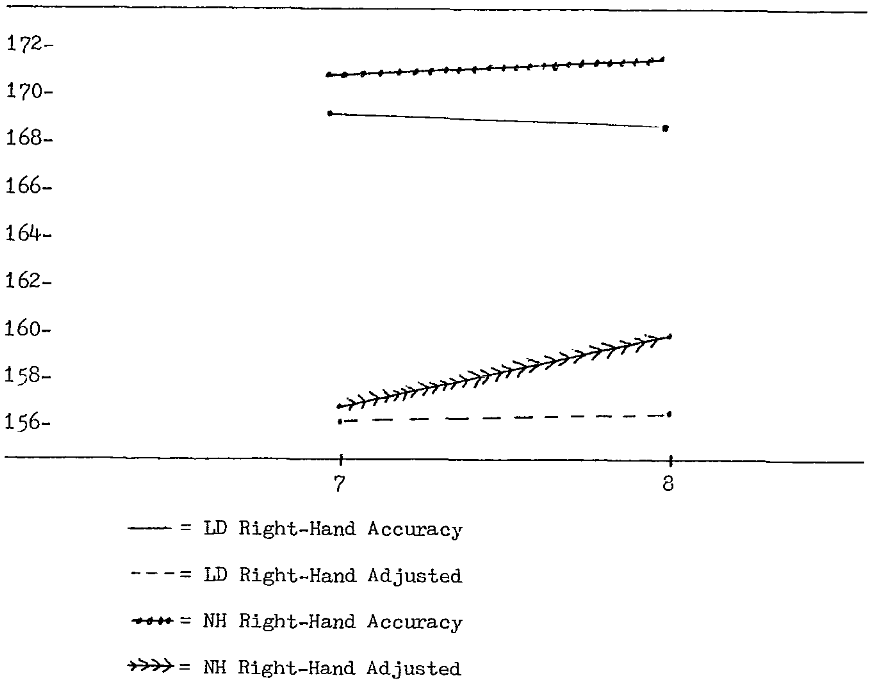
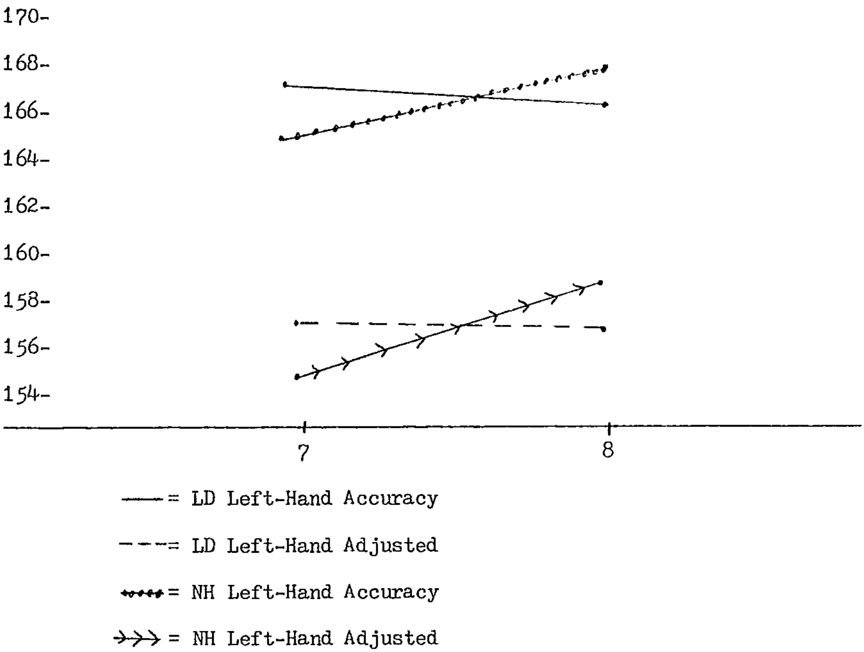


Figure 3

Motor Accuracy-Revised

Mean Scores



Imitation of Postures

Means and standard deviations for the Imitation of Postures subtest are illustrated by Table 7. The results of the analysis of variance for this subtest are shown in Table 8. The graph displayed by Figure 4 represents the mean scores for each group.

There was no significant difference noted between ages for this subtest. However, a significant F value of 5.36 was obtained for the between group factor, indicating that the non-handicapped children scored significantly higher than the learning-disabled children on Imitation of Postures. A significant difference was also evident for the age by group interaction, as an F value of 7.22 was obtained. A Scheffé Post Hoc Test was completed for the age by group interaction data, revealing significantly better scores for the eight-year-old non-handicapped group when compared to each of the three remaining groups. All other pairs of comparisons were non-significant (Table 9).

Table 7

Imitation of Postures

Means and Standard Deviations

Group	7	8	Total
LD	12.33[a] 3.56[b] (6)[c]	11.18 2.56 (11)	11.58 2.90 (17)
NH	12.00 2.45 (8)	15.67 2.27 (12)	14.20 2.93 (20)
Total	12.14 (14)	13.52 (23)	13.00 3.16 (37)

[a] Mean   [b] Standard Deviation   [c] N

Table 8

Imitation of Postures

Analysis of Variance

Source	SS	df	MS	F
Age	13.58	1	13.58	1.97
Group	36.99	1	36.99	5.36*
Age by Group Interaction	49.83	1	49.83	7.22*
Error	227.66	33	6.90	

* = $\underline{P} \angle .05$ $\underline{F}_{(1,33)} = 4.15$

Table 9

Imitation of Postures

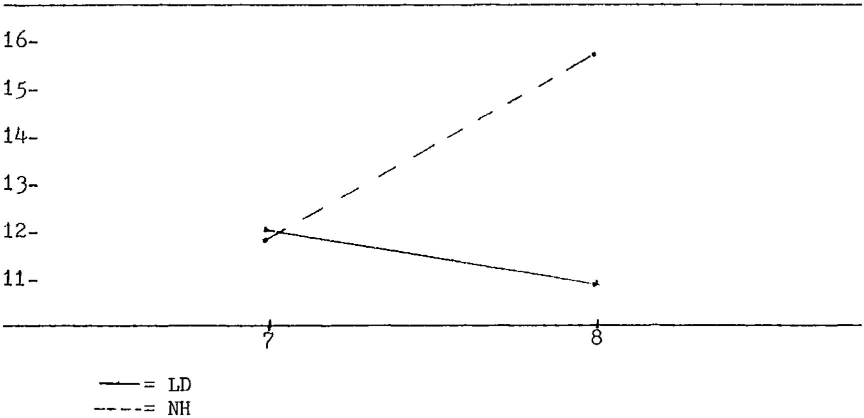
Scheffé Post Hoc Test

	$\bar{X}_{LD-8}$ 11.18	$\bar{X}_{NH-7}$ 12.00	$\bar{X}_{LD-7}$ 12.33	$\bar{X}_{NH-8}$ 15.67
11.18-				*
12.00-				*
12.33-				*
15.67-				

Figure 4

Imitation of Postures

Mean Scores



Crossing Midline of Body

An illustration of the means and standard deviations for the Crossing Midline of Body subtest may be seen in Table 10. Table 11 represents the results of the analysis of variance for this subtest, and Figure 5 denotes the mean scores for each group. A further breakdown of this subtest concerning each hand individually, as well as the crossing aspect of this subtest, may be seen in Appendix E.

There was no significant difference observed between ages for this subtest. An F value of 14.11 was obtained between groups, and was higher than the 4.15 value of $F_{(1,33)}$ which was required, thereby indicating that the non-handicapped children scored significantly higher than the learning-disabled children on this subtest. For age by group interaction, a significant F value of 6.68 was obtained, requiring a Scheffé

Post Hoc Test to be completed for this data. The results of the Scheffé Test revealed that the seven-year-old learning-disabled group performed significantly lower when compared to the other three remaining groups. All other pairs of comparisons were non-significant (Table 12).

Table 10

Crossing Midline of Body

Means and Standard Deviations

Group	7	8	Total
	10.67[a]	17.09	14.82
LD	7.74[b]	4.53	6.44
	(6)[c]	(11)	(17)
	21.00	19.00	19.80
NH	2.88	4.16	3.75
	(8)	(12)	(20)
	16.57	18.09	17.51
Total			5.67
	(14)	(23)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 11

Crossing Midline of Body

Analysis of Variance

Source	SS	df	MS	F
Age	42.01	1	42.01	1.84
Group	321.69	1	321.69	14.11*
Age by Group Interaction	152.32	1	152.32	6.68*
Error	752.24	33	22.80	

* = $\underline{P} < .05$ $\underline{F}_{(1,33)} = 4.15$

Table 12

Crossing Midline of Body

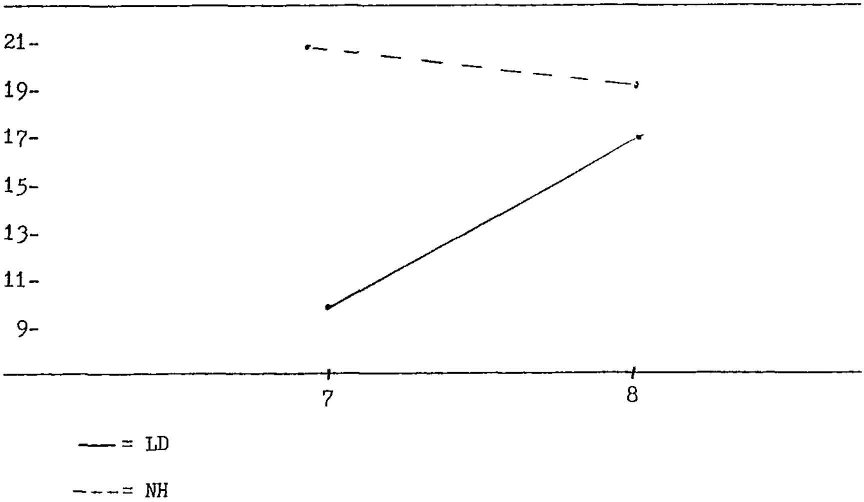
Scheffé *Post Hoc* Test

	$\bar{X}_{LD-7}$ 10.67	$\bar{X}_{LD-8}$ 17.09	$\bar{X}_{NH-8}$ 19.00	$\bar{X}_{NH-7}$ 21.00
10.67-		*	*	*
17.09-				
19.00-				
21.00-				

Figure 5

Crossing Midline of Body

Mean Scores



Bilateral Motor Coordination

Table 13 depicts the means and standard deviations for the Bilateral Motor Coordination subtest, while the results of the analysis of variance are displayed in Table 14. Figure 6 portrays the mean scores for each group on this subtest.

The $\underline{F}$ values of 1.24 and .05 between ages and for age by group interaction, respectively, did not produce any significant differences. An $\underline{F}$ value of 39.93 was obtained between groups, a value which was substantially higher than the 4.15 required for significance at the .05 level, indicating that children classified as learning-disabled scored significantly lower than the non-handicapped children on this subtest.

Table 13

Bilateral Motor Coordination

Means and Standard Deviations

Group	7	8	Total
LD	7.83[a] 2.04[b] (6)[c]	8.54 2.80 (11)	8.29 2.52 (17)
NH	12.75 2.96 (8)	13.83 1.47 (12)	13.40 2.19 (20)
Total	10.64 (14)	11.30 (23)	11.05 3.46 (37)

[a] Mean [b] Standard Deviation [c] N

Table 14

Bilateral Motor Coordination

Analysis of Variance

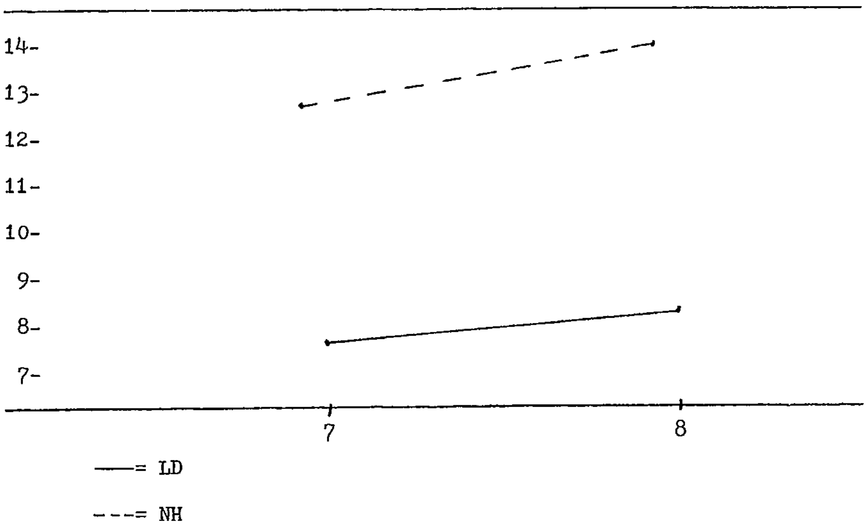
Source	SS	df	MS	F
Age	6.92	1	6.92	1.24
Group	223.50	1	223.50	39.93*
Age by Group Interaction	0.30	1	0.30	0.05
Error	184.73	33	5.60	

* = $\underline{P} < .05$ $\underline{F}_{(1,33)} = 4.15$

Figure 6

Bilateral Motor Coordination

Mean Scores



Right-Left Discrimination

The means and standard deviations for the Right-Left Discrimination subtest are represented in Table 15. The results of the analysis of variance for this subtest may be seen in Table 16. Figure 7 is representative of the mean scores.

A significant F value of 4.30 was evident for the between group comparison, while F values of 1.20 and 0.58 for age and for age by group interaction, respectively, were not found to be significant. The F value for between groups does indicate that the non-handicapped subjects received significantly greater scores on this subtest than did the learning-disabled subjects.

Table 15

Right-Left Discrimination

Means and Standard Deviations

Group	7	8	Total
	13.17[a]	13.73	13.53
LD	6.37[b]	6.12	6.01
	(6)[c]	(11)	(17)
	15.38	18.50	17.25
NH	5.12	1.93	3.78
	(8)	(12)	(20)
	14.43	16.22	15.54
Total			5.21
	(14)	(23)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 16

Right-Left Discrimination

Analysis of Variance

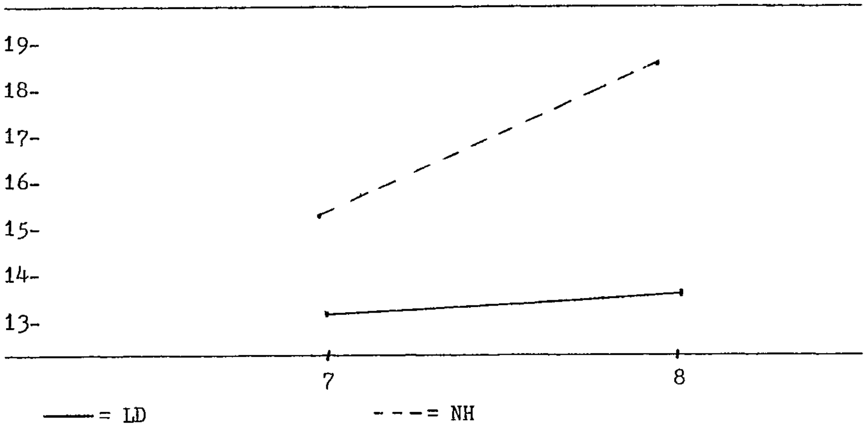
Source	SS	df	MS	F
Age	29.16	1	29.16	1.20
Group	104.60	1	104.60	4.30*
Age by Group Interaction	14.11	1	14.11	0.58
Error	801.89	33	24.30	

* = $\underline{P} < .05$ $\underline{F}_{(1,33)} = 4.15$

Figure 7

Right-Left Discrimination

Mean Scores



Standing Balance-Eyes Open

A representation of the means and standard deviations for the Standing Balance-Eyes Open subtest is shown in Table 17, while Table 18 depicts the results of the analysis of variance for this subtest. A graph of the mean scores for each group is shown in Figure 8. A further breakdown of Standing Balance-Eyes Open by right and left foot is shown in Appendix E.

A significant F value of 4.55 was computed for the between groups factor, indicating that the non-handicapped children performed significantly better than the children classified as learning-disabled. There was no significant difference noted in either the age or the age by group interaction F values.

Table 17

Standing Balance-Eyes Open

Means and Standard Deviations

Group	7	8	Total
LD	34.67[a]	42.00	39.41
	16.18[b]	30.68	26.14
	(6)[c]	(11)	(17)
NH	50.50	101.08	80.85
	48.71	73.49	68.44
	(8)	(12)	(20)
Total	43.72	73.20	61.81
			59.69
	(14)	(23)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 18

Standing Balance-Eyes Open

Analysis of Variance

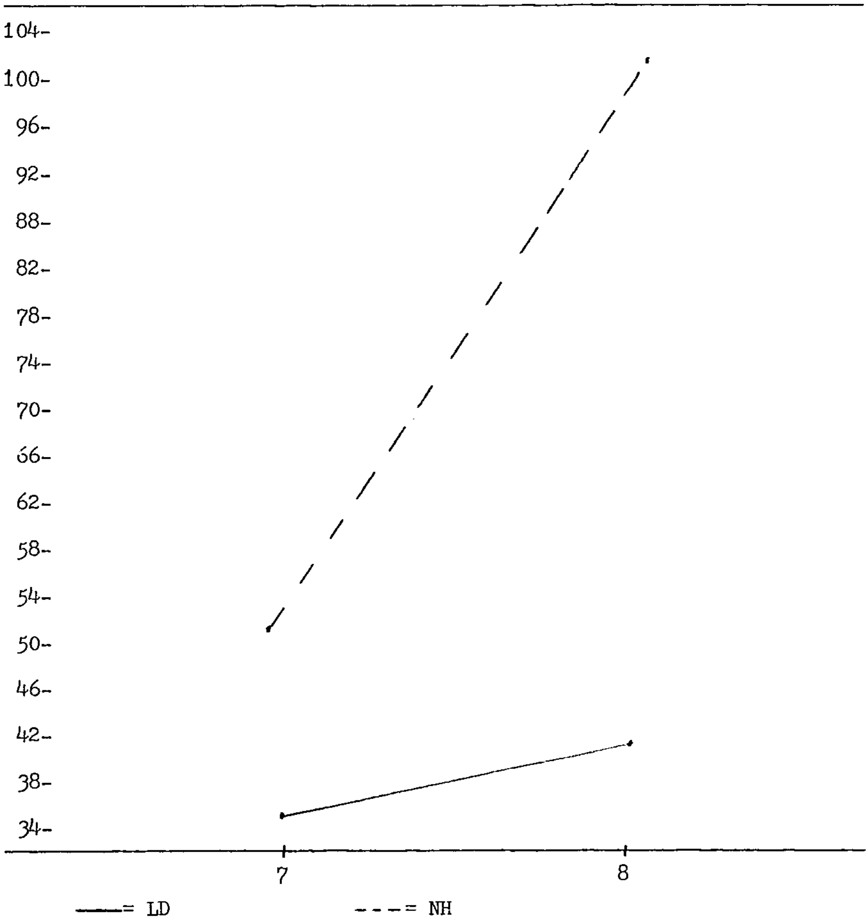
Source	SS	df	MS	F
Age	7199.56	1	7199.56	2.72
Group	12046.36	1	12046.36	4.55*
Age by Group Interaction	4014.86	1	4014.86	1.52
Error	87428.25	33	2649.34	

* = $\underline{P} < .05$ $\underline{F}_{(1,33)} = 4.15$

Figure 8

Standing Balance-Eyes Open

Mean Scores



Standing Balance-Eyes Closed

Tables 19 and 20 display the means and standard deviations, and the results of the analysis for the Standing Balance-Eyes Closed subtest, respectively. A graph of the mean scores for each group is shown in Figure 9. Again, a further breakdown of this subtest is located in Appendix E.

The F values of 3.59 and 2.38 did not produce significant differences for the age and for the group sources, respectively. An F value of 5.67 for the age by group interaction was higher than the 4.15 of $F_{(1,33)}$, and therefore, was significant. A Scheffé Post Hoc Test was completed for the data pertaining to age by group interaction, revealing superior performance for the eight-year-old non-handicapped group compared with the three remaining groups (Table 21).

Table 19

Standing Balance-Eyes Closed

Means and Standard Deviations

Group	7	8	Total
LD	9.33[a] 2.58[b] (6)[c]	7.91 6.06 (11)	8.41 5.05 (17)
NH	6.88 2.30 (8)	19.42 13.49 (12)	14.40 12.12 (20)
Total	7.93 (14)	13.92 (23)	11.65 9.90 (37)

[a] Mean [b] Standard Deviation [c] N

Table 20

Standing Balance-Eyes Closed

Analysis of Variance

Source	SS	df	MS	F
Age	265.28	1	265.28	3.59
Group	175.76	1	175.76	2.38
Age by Group Interaction	418.64	1	418.64	5.67*
Error	2438.03	33	73.88	

* = $P < .05$ $F_{(1,33)} = 4.15$

Table 21

Standing Balance-Eyes Closed

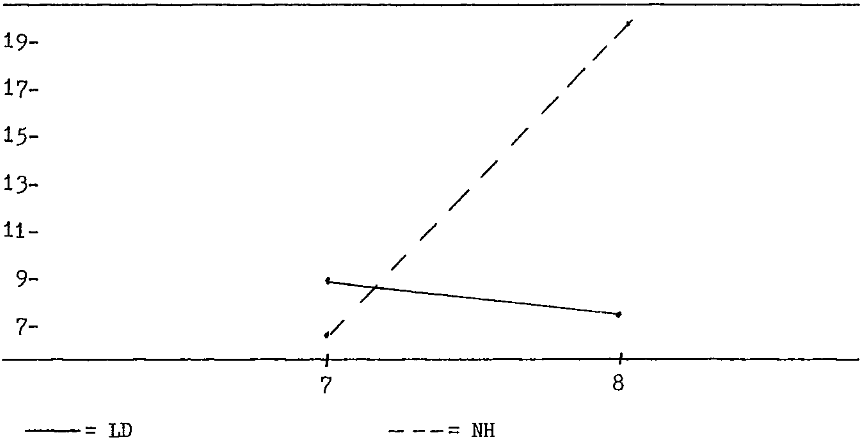
Scheffé *Post Hoc* Test

	$\bar{X}_{NH-7}$ 6.88	$\bar{X}_{LD-8}$ 7.91	$\bar{X}_{LD-7}$ 9.33	$\bar{X}_{NH-8}$ 19.42
6.88-				*
7.91-				*
9.33-				*
19.42-				

Figure 9

Standing Balance-Eyes Closed

Mean Scores



Selected Perceptual-Motor Tasks

The results of the statistical analyses completed for each selected task have been presented in this chapter in the following order: (1) Scooter Activity, (2) Hopscotch Activity, (3) Ball Activity, and (4) Beam Activity.

Scooter Activity

A breakdown of the means and standard deviations for the Scooter Activity may be seen in Table 22. Table 23 displays the results of the analysis of variance completed for this task, and the mean scores for each group are graphed in Figure 10.

An F value of 5.24 was obtained for the between groups comparison and was significant, indicating that the non-handicapped children performed significantly faster than the children classified as learning-disabled. There were no significant differences evident between ages or for the age by group interaction for this task. An F value of 4.97 between trials was significant and therefore displayed that significant improvement was evident for all groups on Trial 2 as compared to Trial 1.

Table 22

Scooter Activity

Means and Standard Deviations

Group	Trial 1 7	Trial 2 7	Trial 1 8	Trial 2 8	Trial 1 Total	Trial 2 Total
	56.00[a]	51.33	64.00	54.11	60.80	53.00
LD	18.02[b]	16.85	23.33	17.74	21.06	16.83
	(6)[c]	(6)	(9)	(9)	(15)	(15)
	50.57	49.50	41.89	37.22	45.69	42.59
NH	12.37	9.12	8.56	8.38	10.96	10.50
	(7)	(7)	(9)	(9)	(16)	(16)
	53.08	50.34	52.94	45.66	53.00	47.63
Total					18.05	14.67
	(13)	(13)	(18)	(18)	(31)	(31)

[a] Mean [b] Standard Deviation [c] N

Table 23

Scooter Activity

Analysis of Variance

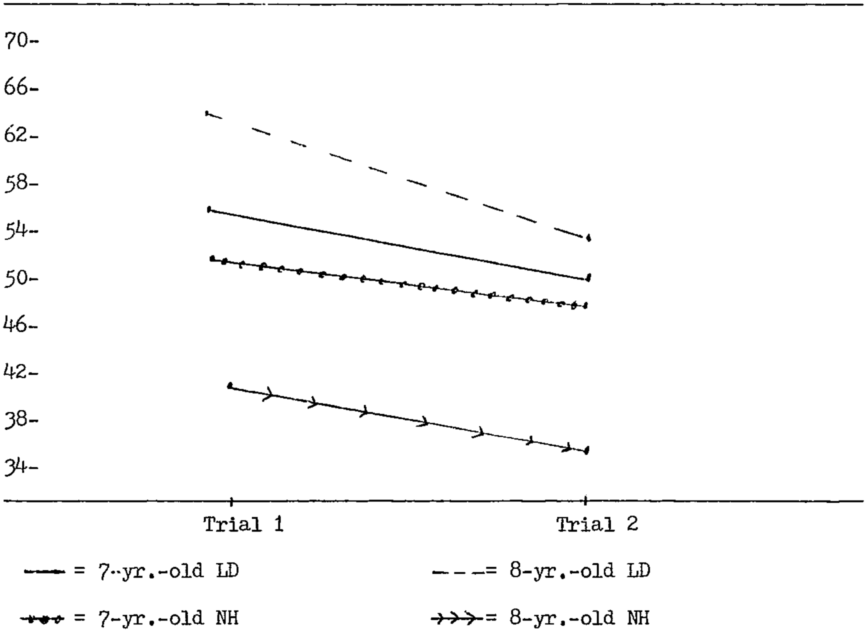
Source	SS	df	MS	F
Age	97.49	1	97.49	0.25
Group	2012.39	1	2012.39	5.24*
Age by Group Interaction	947.17	1	947.17	2.46
Error	10377.16	27	384.34	
Trial	387.24	1	387.24	4.97*
Trial by Age Interaction	73.10	1	73.10	0.94
Trial by Group Interaction	73.10	1	73.10	0.94
Trial by Age by Group Interaction	2.49	1	2.49	0.03
Error	2103.72	27	77.92	

* = $\underline{P} < .05$ $\underline{F}_{(1,27)} = 4.21$

Figure 10

Scooter Activity

Mean Scores



Hopscotch Activity

Table 24 represents a breakdown of the means and standard deviations for the Hopscotch Activity. A display of the results of the analysis of variance may be seen in Table 25, and a graph depicting the mean scores for each group is located in Figure 11 .

A significant F value of 6.28 was obtained between trials, showing a reduction in time to complete the task for all groups from Trial 1 to Trial 2. There were no significant differences for the following factors:

between ages, between groups, age by group interaction, trial by age interaction, trial by group interaction, and trial by age by group interaction.

Table 24

Hopscotch Activity

Means and Standard Deviations

Group	Trial 1 7	Trial 2 7	Trial 1 8	Trial 2 8	Trial 1 Total	Trial 2 Total
	10.25[a]	7.92	10.15	8.75	10.19	8.44
LD	3.13[b]	1.68	8.25	3.97	6.64	3.25
	(6)[c]	(6)	(10)	(10)	(16)	(16)
	7.75	6.00	7.39	6.56	7.56	6.29
NH	2.38	1.69	4.38	4.60	3.48	3.45
	(8)	(8)	(9)	(9)	(17)	(17)
	8.82	4.36	8.84	7.71	8.83	7.33
Total					5.34	3.48
	(14)	(14)	(19)	(19)	(33)	(33)

[a] Mean [b] Standard Deviation [c] N

Table 25

Hopscotch Activity

Analysis of Variance

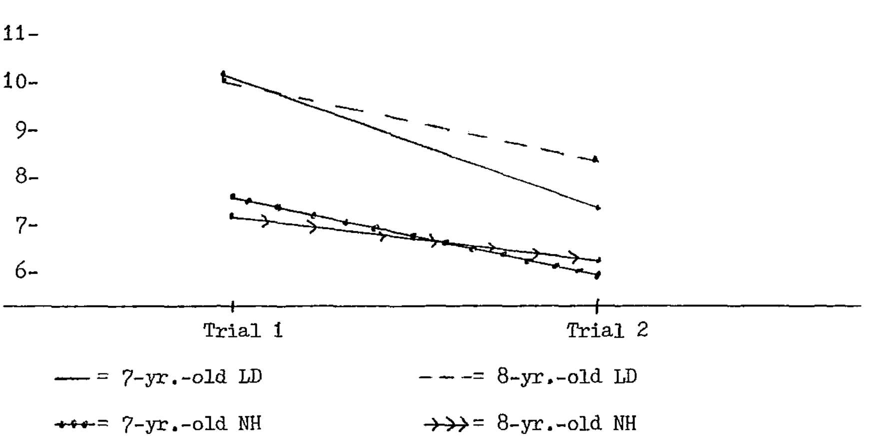
Source	SS	df	MS	F
Age	0.86	1	0.86	0.02
Group	87.35	1	87.35	2.49
Age by Group Interaction	0.29	1	0.29	0.01
Error	1017.23	29	35.08	
Trial	39.68	1	39.68	6.28*
Trial by Age Interaction	3.40	1	3.40	0.54
Trial by Group Interaction	1.32	1	1.32	0.21
Trial by Age by Group Interaction	0.00	1	0.00	0.00
Error	183.12	29	6.31	

* = $\underline{P} < .05$ $\underline{F}_{(1,29)} = 4.18$

Figure 11

Hopscotch Activity

Mean Scores



Ball Activity

One may see the means and standard deviations for the Ball Activity in Table 26, while the results of the analysis of variance are located in Table 27. Figure 12 displays the mean scores for each group in graph form.

A significant F value of 4.78 was obtained between ages, as the eight-year-old children completed the activity significantly faster than the seven-year-old children. An F value of 4.46 was evident for the between trials comparison, again indicating an overall improvement for all groups from Trial 1 to Trial 2.

Table 26

Ball Activity

Means and Standard Deviations

Group	Trial 1 7	Trial 2 7	Trial 1 8	Trial 2 8	Trial 1 Total	Trial 2 Total
	50.83[a]	51.00	43.00	38.89	46.13	43.73
LD	16.58[b]	12.44	17.06	15.04	16.74	14.91
	(6)[c]	(6)	(9)	(9)	(15)	(15)
	47.86	40.71	34.56	26.11	40.38	32.50
NH	11.69	13.46	22.38	16.31	19.19	16.44
	(7)	(7)	(9)	(9)	(16)	(16)
	49.23	45.46	38.78	32.50	43.16	37.94
Total					17.98	16.48
	(13)	(13)	(18)	(18)	(31)	(31)

[a] Mean [b] Standard Deviation [c] N

Table 27

Ball Activity

Analysis of Variance

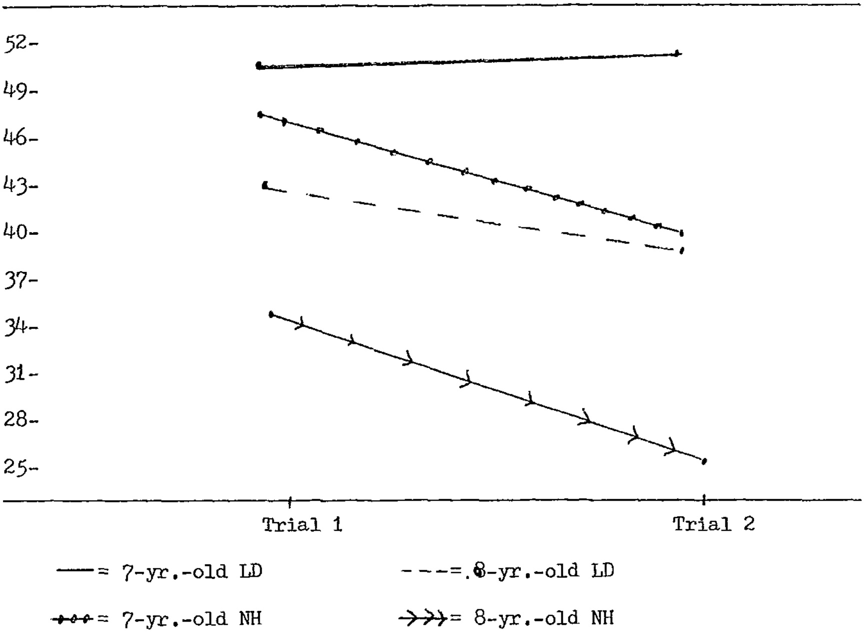
Source	SS	df	MS	F
Age	2152.86	1	2152.86	4.78*
Group	1118.16	1	1118.16	2.48
Age by Group Interaction	59.58	1	59.58	0.13
Error	12157.22	27	450.27	
Trial	358.71	1	358.71	4.46*
Trial by Age Interaction	29.27	1	29.27	0.36
Trial by Group Interaction	127.46	1	127.46	1.58
Trial by Age by Group Interaction	8.33	1	8.33	0.10
Error	2171.90	27	80.44	

* = $\underline{P} < .05$ $\quad \underline{F}_{(1,27)} = 4.21$

Figure 12

Ball Activity

Mean Scores



Beam Activity

Tables 28 and 29 are representative of the means and standard deviations, and the results of the analysis of variance for the Beam Activity, respectively. A graph of the mean scores for this task is shown in Figure 13.

A significant F of 4.26 was obtained for the trial by group interaction. All other factors were non-significant. Results of the Scheffé Post Hoc Test indicated that the non-handicapped group performed significantly better on Trial 2 than the learning-disabled group on Trial 2 and both the learning-disabled and non-handicapped groups on Trial 1.

Table 28

Beam Activity

Means and Standard Deviations

Group	Trial 1 7	Trial 2 7	Trial 1 8	Trial 2 8	Trial 1 Total	Trial 2 Total
	33.67[a]	35.08	30.40	30.50	31.62	32.22
LD	10.80[b]	15.64	8.47	7.76	9.20	11.09
	(6)[c]	(6)	(10)	(10)	(16)	(16)
	35.25	31.81	28.28	22.50	31.56	26.88
NH	13.02	7.57	8.24	7.11	11.00	8.56
	(8)	(8)	(9)	(9)	(17)	(17)
	34.57	33.21	29.40	26.71	31.59	29.47
Total					10.01	10.08
	(14)	(14)	(19)	(19)	(33)	(33)

[a] Mean [b] Standard Deviation [c] N

Table 29

Beam Activity

Analysis of Variance

Source	SS	df	MS	F
Age	579.27	1	579.27	3.54
Group	138.70	1	138.70	0.85
Age by Group Interaction	70.75	1	70.75	0.43
Error	4751.02	29	163.83	
Trial	58.94	1	58.94	2.19
Trial by Age Interaction	13.30	1	13.30	0.49
Trial by Group Interaction	114.54	1	114.54	4.26*
Trial by Age by Group Interaction	1.04	1	1.04	0.04
Error	780.44	29	26.91	

* = $\underline{P} < .05$ $\underline{F}_{(1,29)} = 4.18$

Table 30

Beam Activity

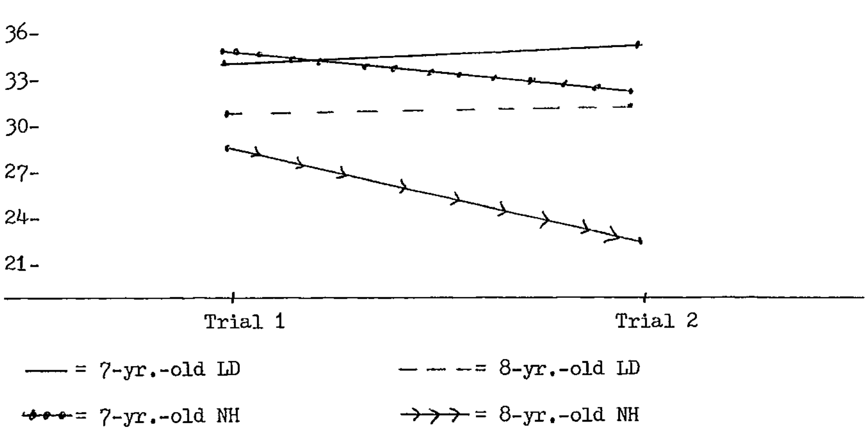
Scheffé *Post Hoc* Test

	$\bar{X}_{LD-2}$ 32.22	$\bar{X}_{LD-1}$ 31.62	$\bar{X}_{NH-1}$ 31.56	$\bar{X}_{NH-2}$ 26.88
32.22-				*
31.62-				*
31.56-				*
26.88-				

Figure 13

Beam Activity

Mean Scores



Discussion

A discussion of the results for each subtest of the Southern California Perceptual-Motor Tests and the selected perceptual-motor tasks are presented in this section.

Southern California Perceptual-Motor Tests

Position in Space

This subtest consisted of 30 items divided into three sections, and was designed by Ayres (1980), "to measure the perception of the same form in different orientations" (p. 2). The results of this subtest revealed means of 16.00 and 15.54 for the seven-year-old and eight-year-old learning-disabled children, respectively, while means of 16.00 and 19.72 for the seven-year-old and eight-year-old non-handicapped children were noted, respectively. No significant F values were seen for this subtest, however, it was interesting to note that the means for both seven-year-old groups were equal, while the means for the eight-year-old groups were representative of the lowest and highest means for the subtest.

This subtest was not an original part of the SCPMT, as it was added in 1976. The highest possible score for Position in Space was 30. One child received a score of 25, with all other scores falling below this, to a low score of 11. The test was completed as soon as a child missed five responses, regardless of the section in which the errors occurred. Each section was presented in a slightly different manner, yet if a child displayed difficulty in the first section and made five errors, he/she never received the opportunity to attempt the remaining sections.

One might tend to question if a valid measure of the child's ability to perceive the same form in different orientations was possible within the confines of this subtest.

Motor Accuracy-Revised

This subtest consisted of one item which was first completed by the preferred hand, then the non-preferred hand of the child. A time factor was utilized as follows: 60 seconds was selected by the examiner as the goal for finishing the task of tracing a specified printed black line. The child was encouraged to complete the task within the time frame, and told to speed up or slow down, accordingly, throughout the test. Ayres (1980) describes this subtest as a test "that employs a motor response in connection with a visual stimulus but emphasizes the motor aspect" (p. 2). She further explains that it was designed to "measure with fine discrimination the accuracy of the visually directed hand use of a pen by neurologically impaired children" (p. 2).

The results of this subtest were divided into accuracy and adjusted scores for each hand individually. No allowances were made concerning which hand was preferred or non-preferred; all data were combined. The accuracy score measured only the child's ability to perform the task, while the adjusted scores included a time factor as well. The means for all groups revealed a higher score for the accuracy portion than the adjusted portion for all sections. This was due to the fact that deductions were made from the accuracy score for the time taken to complete the task. The results of the analysis of variance completed for this subtest revealed no significant differences for the comparisons involved.

According to Ayres (1980), the ability of a child to utilize an instrument to draw a line in a specified direction or distance requires many aspects of neural function. The ability of the child to see the line and to direct his/her vision along that line is a definite requisite, obviously visual in nature. The motor requisites necessary to perform this task are divided by Ayres (1980) into two classes:

> (1) that which is dependent upon upper motor neuron integrity and its centrifugal neuromuscular connections, and (2) praxis, or motor planning, which is closely associated with integration of somatosensory and vestibular input (p. 3).

Ayres (1980) asserts that it is possible to differentiate between the visual and motor sources and interference in performance on the Motor Accuracy-Revised subtest through the incorporation of clinical observations and additional SCSIT scores and vestibular postrotary nystagmus as well.

Imitation of Postures

This subtest consisted of 12 items in which the child imitated the prescribed postures displayed by the examiner. Most items involved the use/movement of the hands/arms, although some items involved movement of the trunk and head as well. This subtest assessed the child's ability to motor plan or program a skilled/nonhabitual motor task (Ayres, 1980).

The results of this subtest revealed almost equal means for the seven-year-old learning-disabled and seven-year-old non-handicapped children, displaying means of 12.33 and 12.00, respectively. The means for groups showed a lesser score for the learning-disabled group, while seven-year-old learning-disabled subjects performed better than eight-year-old learning-disabled subjects, and eight-year-old non-handicapped subjects performed better than seven-year-old non-handicapped subjects, based upon the mean scores. Significant differences were noted between groups, as well as for age by group interaction. The results of a Scheffé Post Hoc Test revealed that eight-year-old non-handicapped children performed significantly better than the remaining three groups. According to Ayres (1980), this subtest was designed as an attempt "to evaluate some of the higher levels of sensory integration, based on assimilation of sensation from several sensory modalities and requiring greater central nervous system processing than in simple somatosensory perception" (p. 5).

Overall, subjects were able to complete each posture within the three to ten second required time frame, regardless of whether the assumed posture was correct or incorrect. It was noted, however, that it was most difficult for the subjects to complete the ninth and twelfth postures within the 10 second time allotment necessary for partial credit. A specific difficulty in test administration concerned the fact that the child was able to change his/her posture at any time within the 10 seconds. In some instances, the child was able to realize that his/her posture was incorrect not through visual cues, but by the fact that the examiner remained in her posture for a longer period of time than on other items.

Crossing Midline of Body

This subtest contained eight items, each of which was completed three times in sequence. The child attempted to mirror image the hand movements of the examiner which were made to the eyes and ears, as quickly as possible. Ayres (1980) stated that this subtest was designed to evaluate the same processes as the Imitation of Postures subtest. She also commented on the fact that an intelligent/test-sophisticated child could possibly perform the test cognitively as well as perceptually, receiving a score more closely related to intellect than sensory integrative status. According to Ayres (1972a), the reluctance of a child to cross midline and engage in activity with his/her hands on the opposite side of the body is more of a tendency than an inability, and is correctable.

The results of this subtest revealed a greater mean for the seven-year-old non-handicapped children than the eight-year-old non-handicapped children, as scores of 21.00 and 19.00 were obtained, respectively. In the case of the learning-disabled group, the opposite was true, as the eight-year-old learning-disabled children obtained a higher mean than the seven-year-old learning-disabled group, with scores of 17.09 and 10.67, respectively. Significant differences were noted between groups, as well as for age by group interaction. A Scheffé Post Hoc Test showed that the seven-year-old learning-disabled group performed significantly lower than the eight-year-old learning-disabled, seven-year-old non-handicapped, and eight-year-old non-handicapped groups.

Although there were no time constraints for this subtest, subjects were urged to imitate the examiner as quickly as possible. Because of this, some subjects became extremely excited and attempted to imitate the examiner too quickly, thereby causing errors in performance to occur. By contrast, in some instances, by the time the examiner repeated the sequence the third time, the subject was able to perform the movement in synchrony with, or even before, the examiner. This was particularly evident concerning the non-handicapped group.

Bilateral Motor Coordination

In this subtest, the subject was to imitate, by mirror image, the sequences of slapping the thighs and clapping the hands performed by the examiner. There were eight total items, and the child was given a second chance to perform each item if it was incorrectly performed. Once again, Ayres (1980) felt that this subtest evaluated the same principles as Imitation of Posture and Crossing Midline of Body. Further, "Both motor planning and integration of function of the two sides of the body are involved. The test score will also be influenced by incoordination of the upper motor neuron type" (Ayres, 1980, p. 5). By contrast, this subtest cannot be performed on a cognitive rather than sensorimotor level, as was the case for the Crossing Midline of Body subtest (Ayres, 1980).

The results of this subtest revealed a significant difference in scores between the two groups, as an $\underline{F}$ value of 33.93 was obtained. Between ages, the eight-year-olds displayed larger means than the seven-year-olds, although there were no significant differences noted.

Ayres (1972a) discussed the fact that children with learning problems, particularly reading, often display difficulties concerning postural and ocular mechanisms, as well as sensorimotor integration of the two sides of the body. Specifically,

> At this time it appears that the deficit in bilateral integration is directly related to the learning problem and that the postural-ocular problem is related to learning in large part because it is directly connected with a neurological mechanism involved in bilateral integration. The exact nature of this relationship is not known (Ayres, 1972a, p. 134).

Right-Left Discrimination

This subtest contained ten items which required the child to answer a specific question or perform a simple task regarding right-left discrimination. Specifically, "The test is a short compilation of the usual items included in tests or discriminating right from left on self, another person, and location of an object" (Ayres, 1980, p. 5).

The results of this subtest revealed similar means for the seven- and eight-year old learning-disabled groups of 13.17 and 13.73, respectively. Significant differences were evident between groups, as an F value of 4.30 was obtained, and means of 13.53 and 17.25 were revealed for the learning-disabled and non-handicapped groups, respectively.

Ayres (1972a) suggested that "right-left discrimination is a faculty that matures only after integration of the two-sides of the body occurs. After the body can function as two integrated halves, it becomes easier for those two halves to be differentiated and to attach verbal labels to them" (p. 139). Furthermore, since right-left discrimination is considered a process or function of maturation within the neural system, it should, and does, occur simultaneously with the development of the integrative process. Ayres (1972a) further elaborated, believing that therapy will not accomplish what she feels "nature" is unable to do, particularly when he/she is past the critical age pertaining to the development of such functions. "Some activities which stress directionality and right-left discrimination are appropriate when maturation in prior steps reaches a plateau" (Ayres, 1972a, p. 164).

Standing Balance-Eyes Open

Standing Balance-Eyes Open contained one item in which the child balanced as long as possible on his/her left foot, then right foot. The ability of the child to balance on each foot, with his/her eyes open and arms crossed on the chest, was tested by this subtest.

The results of this subtest revealed mean scores of 34.67 and 42.00 for the seven-and eight-year-old children classified as learning-disabled, respectively, and scores of 50.50 and 101.08 for seven-and eight-year-old non-handicapped children, respectively. A significant $\underline{F}$ value of 4.55 was obtained between groups.

Subjects were permitted to balance up to 180 seconds on each foot, however, no one reached that level. It was observed by the examiner that subjects who were capable of balancing for an extended period of time became bored with the activity. In some instances it was noted that a subject discontinued the activity not because he/she could no longer perform it, but because he/she was bored. This occurred in all groups, however, it was more prevalent among the non-handicapped children. It also occurred after a longer period of time for the non-handicapped group than the learning-disabled group.

Standing Balance-Eyes Closed

The Standing Balance-Eyes Closed subtest was similar to the Eyes-Open subtest in all regards except that the subject's eyes were closed for this test. Once again, the child's ability to balance on each foot was evaluated, however, visual perception and its contribution to the child's ability to balance were eliminated (Ayres, 1980).

The results of this subtest revealed means ranging from 7.91 for eight-year-old learning-disabled subjects to 19.42 for eight-year-old non-handicapped subjects. Significant differences were noted for the following age by group interactions: the eight-year-old non-handicapped group performed significantly better than the seven-year-old and eight-year-old learning-disabled groups, as well as the seven-year-old non-handicapped group.

This subtest definitely presented more of a challenge to all groups involved. The subjects were willing to accept the challenge, however, they appeared quick to stop the activity when they became the least bit shakey.

Summary of SCPMT Subtests

In summary, significant differences between groups were noted for six of the eight subtests: Imitation of Postures, Crossing Midline of Body, Bilateral Motor Coordination, Right-Left Discrimination, Standing Balance-Eyes Open and Standing Balance-Eyes Closed. (Table 31 contains a summary of the results for the SCPMT). Concerning age by group interaction, three of the eight subtests revealed significant differences: Imitation of Postures (IP), Crossing Midline of Body (CML), and Standing Balance-Eyes Closed (SBC). Specifically, for IP and SBC, the eight-year-old non-handicapped group performed significantly better than the other three groups, while for CML, the seven-year-old learning-disabled group performed significantly lower than the remaining three groups. No significant differences were noted between ages for any of the subtests. The only two subtests which revealed no significant differences were the two newest additions to the SCPMT, Position in Space and Motor

Accuracy-Revised, indicating that their inclusion in the test battery may not necessarily be useful, based upon the results of this study.

Table 31

SCPMT Composite

Analysis of Variance

Subtest	Age	Group	Age by Group Interaction
Position in Space			
Motor Accuracy-Revised			
Imitation of Postures		*	*
Crossing Midline of Body		*	*
Bilateral Motor Coordination		*	
Right-Left Discrimination		*	
Standing Balance-Eyes Open		*	
Standing Balance-Eyes Closed			*

* = $\underline{P} < .05$

Selected Perceptual-Motor Tasks

Scooter Activity

The subject was required to maneuver around seven cones, set at different angles and distances from each other, while remaining on a scooter. The subject was permitted to move on the scooter in any manner he/she desired, except standing, and was encouraged to complete the course as quickly as possible. Deductions were calculated for a variety of errors made during the test (Appendix D), resulting in additional time added to the raw time required for the subject to complete the task. The results of this task revealed mean scores which improved from Trial 1 to Trial 2 for all groups. Significant $\underline{F}$ values of 5.24 and 4.97 were obtained between groups and between trials, respectively.

Most errors committed on this task concerned touching cones with either the scooter or the body, as 11 of 17 learning-disabled subjects and six of 20 non-handicapped subjects did so on Trial 1, and seven learning-disabled and seven non-handicapped subjects did so on Trial 2. Overall, subjects were careful when going around the cones, attempting to go around in the proper order, as well as to remain on the scooter at all times. The learning-disabled group displayed more of a tendency to use their arms to move the scooter, while the non-handicapped group displayed more of a tendency to use the legs or a combination of their arms and legs to move themselves through the course.

Hopscotch Activity

The subject was required to hop/jump as appropriate through a course of hoops set up in a single/double fashion. He/she was encouraged to move through the hoops as quickly as possible, while being cautious not to commit a variety of errors (Appendix D) which resulted in additional time being calculated into his/her raw time. The results of this task revealed mean scores which improved from Trial 1 to Trial 2 for all groups. A significant F value of 6.28 was obtained between trials for this task, displaying the significant improvement from Trial 1 to Trial 2 regardless of age or group. No further significant F values were noted.

Most errors committed for this task concerned double hopping/jumping in a hoop. Thirteen of 17 learning-disabled and seven of 20 non-handicapped subjects committed this error during Trial 1. This number decreased to eight learning-disabled and two non-handicapped subjects for Trial 2. In general, few subjects had difficulty with this activity, regardless of age or group, although one non-handicapped subject double hopped/jumped six and eight times on Trial 1 and Trial 2, respectively, while one learning-disabled subject committed the same error two and five times, respectively. In viewing raw time without errors, two non-handicapped subjects were able to complete the task in 3.5 seconds, while one learning-disabled subject took 13 seconds to complete the task, all three occurring in Trial 2.

Ball Activity

The subject was required to bounce a playground ball through a course of six hoops set at different distances and angles from each other, using just one hand and allowing the ball to bounce just one time in each hoop. Subjects were encouraged to complete the course as quickly as possible, but were also encouraged to commit as few errors as possible while doing so. Additions of time to raw time taken to complete the task were calculated for the variety of possible errors which were committed (Appendix D).

Results of this task revealed improvement in mean scores from Trial 1 to Trial 2 for the eight-year-old learning-disabled, seven-year-old non-handicapped and eight-year-old non-handicapped groups. The seven-year-old learning-disabled group showed a minimal increase in mean scores from Trial 1 to Trial 2, displaying scores of 50.83 and 51.00, respectively. Significant F values of 4.78 and 4.46 were evident between ages and between trials, showing significantly better scores for eight-year-olds as compared to seven-year-olds, and significant improvements from Trial 1 to Trial 2, regardless of age or group. Errors committed for this task were more diversified than on the first two tasks. Prevalence was noted for (1) stepping in/on hoops, (2) touching hoops with the ball, (3) discontinuing bouncing, and (4) bouncing the ball more than one time in a hoop. Specifically, the following errors were noted for Trial 1: (1) 11 of 17 learning-disabled and 11 of 20 non-handicapped subjects committed this error, (2) 11 learning-disabled and eight-non-handicapped subjects, (3) eight learning-disabled and eight non-handicapped subjects, and (4) 10 learning-disabled and eight non-handicapped subjects. There was little differentiation concerning types of errors committed between the learning-disabled and non-handicapped groups, indicating similarity in motor performance between the groups.

Beam Activity

The subject was required to walk across an L-shaped low beam while simultaneously going over and under 6 hurdles set at various heights and distances across the beam. He/she was encouraged to complete the task as quickly as possible, while being cautious not to commit any of a variety of errors which caused the addition of seconds to be calculated to the raw time taken to complete the task (Appendix D).

The results of this task revealed an improvement in mean scores for both the seven-and eight-year-old non-handicapped groups from Trial 1 to Trial 2, while a decrease in mean scores was evident for the seven-and eight-year-old learning-disabled groups from Trial 1 to Trial 2. A significant F value of 4.26 was obtained for trial by group interaction.

The most prevalent errors noted for this task were for knocking off hurdles and touching the floor. Specifically, during Trial 1, nine of 17 learning-disabled and 14 of 20 non-handicapped subjects knocked off hurdles, and 13 learning-disabled and 14 non-handicapped subjects touched the floor. For Trial 2, seven learning-disabled and 11 non-handicapped subjects knocked off hurdles, and 14 learning-disabled and 13 non-handicapped subjects touched the floor. These results indicate definite similarities in motor performance between groups. In fact, on this specific subtest, motorically, the learning-disabled children performed better than the non-handicapped children concerning the committing of certain errors. However, the fact that the non-handicapped children performed the task in less time prior to deductions afforded them better overall scores than the learning-disabled children for both trials.

Summary of Selected Perceptual-Motor Tasks

In summary, significant differences between trials were noted for three of the four tasks: the Scooter, Hopscotch and Ball Activities. (Table 32 contains a summary of the results for the selected tasks). Between groups results on the Scooter Activity revealed significant differences, while significant between age differences were noted for the

Ball Activity. Concerning trial by group interactions, the Beam Activity revealed significant differences as follows: the total non-handicapped group performed significantly better on Trial 2 than either group on Trial 1 and the learning-disabled group on Trial 2. No significant differences were evident for age by group interaction, trial by age interaction or trial by age by group interaction for any of the tasks. Improvement in times from Trial 1 to Trial 2 which revealed significant differences for the Scooter, Hopscotch and Ball Activities, as well as improvement for the seven-and eight-year-old non-handicapped groups on the Beam Activity, indicated that a certain amount of learning was evident in completing the tasks from Trial 1 to Trial 2.

Table 32

Selected P-M Tasks Composite

Analysis of Variance

Task	Age	Group	A X G	Trial	T X A	T X G	T X A X G
Scooter Activity		*		*			
Hopscotch Activity				*			
Ball Activity	*			*			
Beam Activity						*	

* = $\underline{P} < .05$

The Scooter Activity was the only selected task which showed between group differences. In this task, the subjects were permitted to choose how they would utilize the scooter to manipulate through the cones. The learning-disabled group generally used their hands to propel the scooter, kneeling or laying on it. The non-handicapped group generally utilized either their feet or a combination of hands and feet, sitting on the scooter and moving backwards with their feet or lying on the scooter and using their hands and feet, although the latter was less prevalent. Perhaps more specific directions were necessary in this case for the learning-disabled children--if told how to move on the scooter, perhaps they would have performed in a manner which would have improved their scores.

Chapter Summary

Significant between group differences were evident on only one of the four selected tasks, while they were seen in six on the eight subtests of the SCPMT. These results may indicate that while definite perceptual-motor differences between children classified as learning-disabled and non-handicapped are evident on perceptual-motor tests, these differences may not carry over to the performance of actual perceptual-motor tasks. If a physical educator were to utilize the scores collected in this study for evaluation/placement purposes, the learning-disabled children would show large deficits in comparison with their non-handicapped peers and would possibly require adapted or special physical education services. However, based upon the results of the selected tasks, this may not be the case. Observational techniques should definitely be utilized in conjunction with standardized tests. Within group differences were evident on the selected tasks, as children in each group performed much differently than their learning-disabled or non-handicapped peers. Non-handicapped subjects who were overweight or appeared to be academically-oriented performed differently than their non-handicapped peers who were of acceptable weight or were more interested in sports. In comparison, learning-disabled subjects who were sports-oriented (i.e.; interested in sports, involved in city sports programs) performed better than their learning-disabled peers on the selected tasks.

Evaluation and placement of children in physical education must be made through a combination of observation and standardized test scores. Differences and similarities between children which may not be significant or evident on standardized tests may be seen through observation of the child on actual motor skill performance. Similarly, significant differences which are evident on perceptual-motor tests may not carry over to actual skill performance by the child. Placement in adapted or special physical education for children classified as learning-disabled should not be automatic, nor should placement be made solely upon the results of standardized test scores. Similarly, placement in the general physical education classroom should not be automatic to the non-handicapped child, as he/she may display the same or similar movement deficits as the child classified as learning-disabled.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to determine if differences exist in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Southern California Perceptual-Motor Tests (SCPMT) and four selected perceptual-motor tasks. The SCPMT consisted of eight subtests: (1)Position in Space, (2)Motor Accuracy-Revised, (3)Imitation of Postures, (4)Bilateral Motor Coordination, (5)Right-Left Discrimination, (6)Crossing Midline of Body, (7)Standing Balance-Eyes Closed. The four selected perceptual-motor tasks included: (1)a Scooter Activity, (2)a Hopscotch Activity, (3)a Ball Activity, and (4)a Beam Activity.

The SCPMT was administered to 37 subjects, and the selected tasks to 31 subjects. Each subtest and task was administered and scored for each subject individually in his/her own school setting. Two trials were given for each task. One person was required to administer the SCPMT, while a second person scored the test; one person administered and scored the selected tasks, and a second person timed them.

An analysis of variance procedure (ANOVA) was utilized to analyze the data collected in this study. Child classification was represented on one factor, and age on the second. A two-way ANOVA was computed for the raw scores of each of the eight subtests of the SCPMT, and a three-way ANOVA with repeated measures was completed for each of the four selected tasks, with the two trials representing the repeated measures. A significant F value at the .05 level of significance was adopted for this study. A Scheffe Post Hoc Test was calculated to determine the specific location of significant interactions evident in the data.

Results of the statistical analyses revealed consistency in results for the SCPMT, but not necessarily in the perceptual-motor tasks. Between group differences which favored the non-handicapped group were observed in five of the eight SCPMT subtests, while age by group interactions were noted on three of the SCPMT subtests. No significant differences were observed between ages for the SCPMT, while one selected task (Ball Activity) displayed a significant between age difference, indicating better scores for the eight-year-olds. Between trial differences indicating better performance on Trial 2 were noted on the Scooter, Hopscotch, and Ball Activities, while a trial by group interaction indicating that the non-handicapped group performed better on Trial 2 than all other groups on both trials was noted on the Beam Activity. No significant differences were evident for age by group interaction, trial by age interaction or trial by age by group interaction for any of the selected perceptual-motor tasks.

Conclusions

The following null hypotheses were adopted for this study, and are accompanied by the coinciding conclusions based upon the results of the study:

Hypothesis 1. There will be no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Southern

California Perceptual-Motor Tests.

Concerning between group comparisons, the null hypothesis was accepted for Position in Space and Motor Accuracy-Revised, as no significant differences were noted, and was rejected for Imitation of Postures, Crossing of Body, Bilateral Motor Coordination, Right-Left Discrimination, Standing Balance-Eyes Open, and Standing Balance-Eyes Closed, as significant differences favoring the non-handicapped subjects were noted for these subtests. Concerning age by group interaction, the null hypothesis was accepted for Position in Space, Motor Accuracy-Revised, Bilateral Motor Coordination, Right-Left Discrimination, and Standing Balance-Eyes Open, as no significant differences were noted, and was rejected for Imitation of Postures, Crossing Midline of Body, and Standing Balance-Eyes Closed, as significant differences were noted for these three subtests, indicating that the eight-year-old non-handicapped group performed better than all remaining groups for IP, the seven-year-old learning-disabled group performed lower than the remaining three groups on CML, and the eight-year-old non-handicapped group performed better than all other groups on SBC. The null hypothesis was accepted for all eight subtests of the SCPMT between ages, as no significant differences were noted.

Hypothesis 2. There will be no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Scooter Activity.

The null hypothesis was rejected for the between group comparison, as significant differences were noted between groups for this task.

The null hypothesis was accepted between ages and for age by group interaction, as no significant differences were noted here. The null hypothesis was rejected for between trials as significant differences were noted, favoring Trial 2, and accepted for trial by age interaction, trial by group interaction, and trial by age by group interaction.

Hypothesis 3. There will be no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Hopscotch Activity.

The null hypothesis was accepted between ages, between groups and for age by group interaction, as no significant differences were noted. The null hypothesis was rejected between trials as significant differences were evident. No significant interaction effects were noted.

Hypothesis 4. There will be no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Ball Activity.

The null hypothesis was rejected between ages and between trials as significant differences were evident. The null hypothesis was accepted between groups, age by group interaction, trial by age interaction, trial by group interaction, and trial by age by group interaction, as no significant differences were evident.

Hypothesis 5. There will be no significant difference in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Beam Activity.

The null hypothesis was rejected for trial by group interaction, as significant differences were evident which indicated that the non-handicapped group performed significantly better on Trial 2 than the learning-disabled group on Trial 2 and both the learning-disabled and non-handicapped groups on Trial 1. The null hypothesis was accepted between ages, between groups, and between trials, as well as for age by group interaction, trial by age interaction and trial by age by group interaction, as no significant differences were noted.

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APPENDIX A

Reliability for the Southern California Perceptual-Motor Tests

(n = number of subjects; r = Product Moment Correlation) (Ayres, 1980).

Subtest	Age Level	n	r
IP	7.0-7.11	53	.29
	8.0-8.11	56	.29
CML	7.0-7.11	53	.39
	8.0-8.11	36	.12
BMC	7.0-7.11	53	.38
	8.0-8.11	36	.33
RLD	7.0-7.11	53	.54
	8.0-8.11	36	.15
SBO	7.0-7.11	53	.68
	8.0-8.11	36	.55
SBC	7.0-7.11	53	.20
	8.0-8.11	36	.51
PS	7.0-7.11		.66
	8.0-8.11		.41

For the MAC-R subtest, 36 right-handed and three left-handed children five-to ten-years-old were tested, with the following results obtained:

	30 seconds accuracy	30 seconds adjusted	60 seconds accuracy
r	.74	.73	.83

	60 seconds adjusted	120 seconds accuracy	120 seconds adjusted
r	.83	.81	.73

APPENDIX B

SCHOOL DISTRICT OF LA CROSSE

HOGAN ADMINISTRATIVE CENTER
807 East Avenue South
La Crosse, WI 54601
608 ~~785-0275~~ 784-8960

SUPERVISOR OF CURRICULUM
KATHRYN S. CAPPELEN

April 15, 1983

Ms. Dorothy Mehrman
University of Wisconsin-La Crosse
17th and State Sts.
La Crosse, WI 54601

Dear Ms. Mehrman:

On April 13, 1983 the Research and Development Committee, along with Steve Lang, Supervisor of Special Education, met to review your project, A Comparison of the Perceptual-Motor Performance of Seven- and Eight-Year-Old Children Classified as Learning Disabled and Seven- and Eight-Year-Old Non-Handicapped Children. You are to be commended for the very professional manner in which you completed the Research/Survey Overview form. I am please to inform you that the committee approved your project.

Please contact me in the near future so we can make the necessary arrangements for initiating your research.

Sincerely,

Kathryn Cappelen

Kathryn Cappelen
Supervisor of Curriculum

KC/lg

SCHOOL DISTRICT OF LA CROSSE

MEMO

TO : Elementary Principals / L.D. TEACHERS DATE : 4/15/83

FROM : Research and Development Committee - Kathryn Cappelen KC

SUBJECT : Research by Dorothy Mehrman

On Wednesday, April 13, 1983 the Research and Development Committee met to evaluate the project developed by Dorothy Mehrman. The title of her project was, A Comparison of the Perceptual - Motor Performance of Seven- and Eight-Year-Old Children Classified as Learning Disabled and Seven- and Eight-Year-Old Non-Handicapped Children. In addition to members of the committee, Steve Lang was also in attendance.

The R & D Committee did approve this project. Because this project may involve all the elementary schools and because time is of the essence, instead of using the Principal's Response Sheet, it was felt that a memo would better serve the purpose.

Steve Lang felt the study would be of value to the Learning Disabilities teachers. Steve, along with the LD teachers, will assume the responsibility of setting up the project. In the near future Mr. Lang will be contacting the LD teachers. Letters to the parents will be sent out of Hogan Special Education Office.

Attached are some paragraphs taken from the study to give you some background concerning the project. Please talk this project over with your LD teacher. If you have any questions, please contact Steve Lang. As principal, you still have the prerogative to state that you do not want your school to participate in this project.

Statement of the proposed project

The purpose of this study is to determine if there is a difference in performance among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children on the Southern California Perceptual-Motor Tests and selected perceptual-motor tasks. A second purpose of this study is to determine if any differences which occur on the Southern California Perceptual-Motor Tests and selected perceptual-motor tasks increase or decrease with age among seven-and eight-year-old children classified as learning-disabled and seven-and eight-year-old non-handicapped children.

C. Procedure for data collection

1. The subjects to be utilized in this study will be children from the La Crosse Public School District. The following population has been chosen:

   15 seven-year-old children classified as learning-disabled

   15 seven-year-old non-handicapped children

   15 eight-year-old children classified as learning-disabled

   15 eight-year-old non-handicapped children

2. The subjects utilized in this study are to be matched in the following manner: Fifteen seven-year-old and 15 eight-year-old children classified as learning-disabled will be chosen from a population identified as learning-disabled by the Director of Special Education in the La Crosse Public School District. .ne non-handicapped population will be identified by the School District of La Crosse and the Director of Special Education, and will be matched to the learning-disabled classified population based on age, school and sex.

   ***All information necessary concerning the subjects involved in this study may be provided without the researcher reviewing the behavioral files of the children, if it can be provided by the Director of Special Education and/or the La Crosse Public School District.

3. a)a pilot study will be run prior to the start of actual testing for this study so as to insure the competence of those administering the Southern California Perceptual-Motor Tests(SCPMT)and the selected perceptual-motor tasks, as well as those scoring and recording the results;

   b)each subject will be tested individually;

   c)the SCPMT and the selected perceptual-motor tasks will be administered to each subject on two separate days, with at least on day between each to break up the amount of time out of the classroom, as well as alleviate any fatigue problems which may possibly occur;

   d)time committment of each subject: approximately 45 minutes for the SCPMT, and approximately 30 minutes for the selected perceptual-motor tasks; and

   e)a two-way analysis of variance will be utilized to analyze the data collected in this study. There will be two levels on each factor:

seven-year-olds and eight-year-olds, and those children classified as learning-disabled and non-handicapped children. A two-way analysis of variance will be run for the SCPMT, and for each perceptual-motor task performed.

IV. SIGNIFICANCE OF THE PROJECT

A. For the school district

Upon completion of this project, it is hoped that the following information obtained from this study will prove to be valuable and beneficial to the La Crosse Public School District, and that it will be useful in assessing, placing and planning for the child classified as learning-disabled, as well as for the non-handicapped child:

1. data pertaining to the perceptual-motor skills of seven-and eight-year-old learning-disabled children in the district;
2. data pertaining to the perceptual-motor skills of seven-and eight-year-old non-handicapped children in the district; and
3. implications of physical education for learning-disabled children with perceptual-motor difficulties.

KC/lg

SCHOOL DISTRICT OF LA CROSSE

MEMO

TO: DATE: 4/19/83

FROM: Steve Lang Steve Lang

SUBJECT: Research Project

Please use this form to identify students for the University of Wisconsin - LaCrosse research project on learning disabilities. This is the project that I spoke with you briefly about on the telephone.

1. Remember, please identify from one to five learning disabled students who are either <u>seven</u> or <u>eight</u> years of age in your program.
2. Please identify an equal number of non-EEN students who you can match by age and sex in your building. By average, I mean any seven or eight year old student who is at or above grade level, who has never been referred and currently spends 100% of their day in regular education.

Results of the study, of course, will be made available to you and the School District thanks you for your participation in this research. Please provide this information by April 28. The graduate students will be doing all of the assessment. The Special Education Office will take care of the letters to parents, securing their permission, etc.

For your information, I am enclosing a copy of the research proposal.

SRL/cs
enc.

SCHOOL ______________________

NAME	SEX	AGE	ADDRESS	PHONE	PARENTS	L.D.
						☐ YES ☐ NO
						☐ YES ☐ NO
						☐ YES ☐ NO
						☐ YES ☐ NO
						☐ YES ☐ NO
						☐ YES ☐ NO
						☐ YES ☐ NO

APPENDIX C

University of Wisconsin - La Crosse

La Crosse, Wisconsin 54601 (608) 785-8000

April 15, 1983

Dear Parents:

As a graduate student in the Physical Education for the Handicapped Program, I will be conducting thesis research to examine the perceptual-motor performance of seven-and eight-year-old children classified as learning-disabled and non-handicapped. A perceptual-motor skills test and selected movement tasks will be administered to each child involved in the study. Evaluation of perceptual-motor ability on the test will be based on standardized scores, and evaluation of the selected tasks will be done by the researcher. This study has been approved by the Research and Development Committee of the La Crosse School District.

Your child has been identified as a potential participant in this study. The perceptual-motor skills test will take approximately 45 minutes to administer, and the selected movement tasks will take approximately 30 minutes, thereby making the total time commitment of your child approximately one hour and fifteen minutes. The test and tasks will be administered to each child individually on two separate days, so as to break up the amount of time out of the classroom, as well as to alleviate any fatigue problems which might possibly occur. All information obtained in this study will remain strictly confidential, and no information pertaining to your child will be released to anyone outside of this study. With your permission, the information gathered in this study will be used for statistical or scientific purposes only, however, your child's test scores will be provided to you upon request. Aside from the initial identification, your child's name will not be used, rather, a code/number system will be utilized to insure the anonimity of your child.

Your cooperation concerning this project will be greatly appreciated. Please note the Parental Consent Form which accompanies this letter. It requires your child's name, address, date of birth and phone number, as well as your signature. Please return the consent form as soon as possible, as testing will begin the week of May 2.

If you have any questions, please feel free to contact me at school or at home. I will be glad to answer any questions you may have.

Sincerely,

Dorothy T. Mehrman

Dorothy T. Mehrman
Home: 784-9403 School: 785-8693

Joy C. Greenlee

Dr. Joy C. Greenlee
Thesis Committee Chairperson

SCHOOL DISTRICT OF LA CROSSE

HOGAN ADMINISTRATIVE CENTER
807 East Avenue South
La Crosse, WI 54601
608 784-8960

SUPERVISOR OF
SPECIAL EDUCATION
STEVE LANG

PARENTAL CONSENT FORM

CHILD'S NAME: ______________________ DATE OF BIRTH: ____________

ADDRESS: ______________________ PHONE NUMBER: ____________

INFORMED CONSENT

I understand that the purpose of this study is to learn more about the perceptual-motor performance of seven and eight year old children classified as learning disabled, and seven and eight year old non-handicapped children.

I confirm that my child's participation as a subject is entirely voluntary. No coercion of any kind has been used to obtain my cooperation.

I understand that I may withdraw my consent and terminate my child's participation at any time during the investigation.

I have been informed of the procedures that will be used in the study and understand what will be required of my child as a subject.

I understand that information gathered in this study will be used for statistical and scientific purposes only.

I wish to grant approval for my child's participation as a subject.

SIGNED: ______________________
Parent of Guardian

DATE: ______________________

Please return the signed form as soon as possible to:

SPECIAL EDUCATION OFFICE
HOGAN ADMINISTRATIVE CENTER
807 EAST AVENUE SOUTH
LA CROSSE, WI 54601

Thank you again for your cooperation.

**Adapted from L.F. Locke and W.W. Spirduso Proposals that work. (New York: Teachers College Press, 1976), p. 237.

University of Wisconsin - La Crosse

La Crosse, Wisconsin 54601 (608) 785-8000

May 9, 1983

Dear Parents:

This follow-up letter is being sent to the parents of all children identified as possible participants in my thesis study. If you will recall, I am examining and comparing the perceptual-motor performance of seven-and eight-year-old children classified as non-handicapped and learning-disabled. If you have already returned the consent form, thank you for your cooperation.

If you have not yet completed the form, please take the time to do it now. I have enclosed a second copy of the consent form, and ask that you return it signed if you are granting permission for your child to participate, or unsigned if you would prefer that your child not participate. Your cooperation and expedient response will be greatly appreciated, as we are rapidly approaching the end of the school year.

Again, let me remind you that all testing information and results concerning your child will remain strictly confidential, and will be released to you upon request. If you have any questions, please feel free to contact me at school or at home. I will be glad to answer any questions you may have.

Thank you again for your cooperation.

Sincerely,

Dorothy T. Mehrman

Dorothy T. Mehrman
Home: 784-9403 School: 785-8693

Joy C. Greenlee

Dr. Joy C. Greenlee
Thesis Committee Chairperson

APPENDIX D

PERCEPTUAL-MOTOR TASKS

SCOOTER ACTIVITY

Equipment: 7 cones, 1 scooter, stop watch, start/finish lines

Seven cones were set at different distances and angles from each other. The child propelled him/herself on the scooter in any manner he/she saw fit, except standing, moving around the cones. The child was to move as quickly as possible from start to finish, as time was kept for the station.

Deductions were made for the following errors: touching or knocking over cones, missing a cone entirely, falling off the scooter, or going around the cones in the wrong order.

HOPSCOTCH ACTIVITY

Equipment: 13 hoops, stop watch, start/finish lines

Thirteen hoops were set in a specific pattern on the floor, alternating single and double hoops. The child was to hop/jump from hoop to hoop, placing only one foot in each hoop, as if he/she were playing hopscotch. The child was to move as quickly as possible from start to finish, as time was kept for this station.

Deductions were made for the following errors: touching a hoop, double hopping/jumping in the hoops, missing a hoop entirely, placing two feet in one hoop and losing balance (stepping/falling out of sequence).

BALL ACTIVITY

Equipment: 8-1/2" playground ball, 6 hoops, stop watch, start/finish lines

Six hoops were set at different distances and angles from each other. The child began at the starting line, bouncing the ball continuously with one hand, moving to the first hoop. He/she bounced the ball 1X in the hoop, then continued to the next hoop. The child was to keep the ball bouncing throughout the activity. If the child lost control of the ball, he/she was to retrieve the ball and return to the place where he/she lost it. The test was to aid the child in returning to the proper retrieving the ball if necessary. The child was to move as quickly as possible from start to finish, as time was kept for this station.

Deductions were made for the following errors: touching a hoop with the ball, bouncing the ball more than 1X in a hoop, missing a hoop entirely, using two hands to bounce the ball, discontinuing bouncing at any time before the finish line, and stepping on or in a hoop. Deductions were not made for losing control of the ball, as the child lost time when retrieving the ball and no need was seen by the researcher for a double penalty.

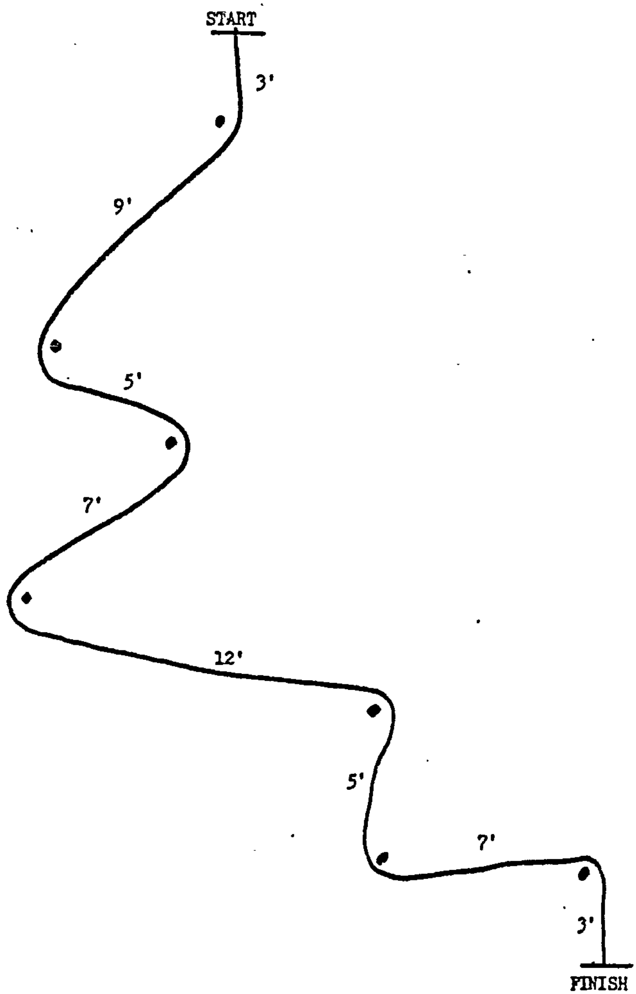
BEAM ACTIVITY

Equipment: L-shaped beam, 6 hurdles, stop watch

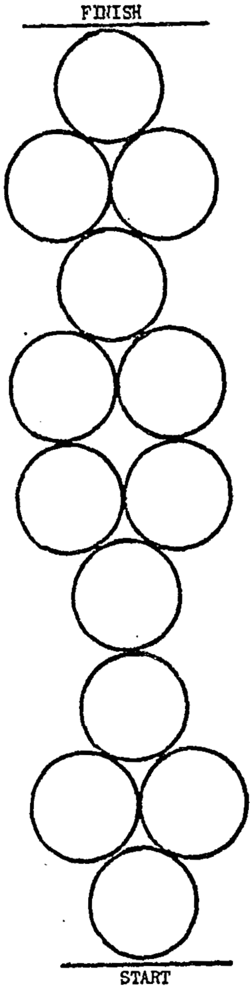
The child was to move across the beam in any manner he/she saw fit. The hurdles were set at various heights and distances across the beam, with the child going over/under each hurdle as designated by an arrow attached to the hurdles. The child was to move as quickly as possible from start to finish, as time was kept for this station. The beam was designed and constructed by the researcher, as were the hurdles. The hurdles were such that the cross piece was balanced upon the two standards, allowing it to fall in three separate pieces if knocked over.

Deductions were made for the following errors: touching or knocking off hurdles, touching the floor with any body part, and going over a hurdle instead of under and vice versa.

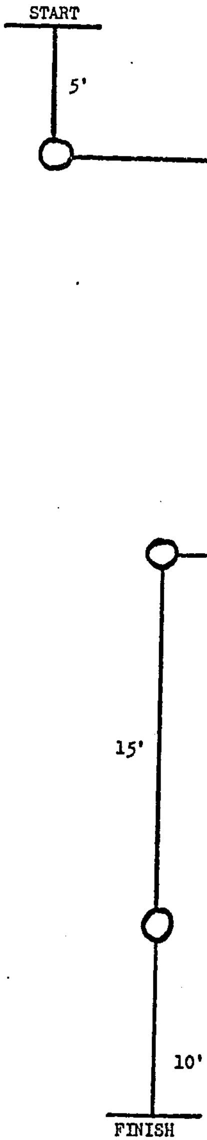
SCOOTER ACTIVITY



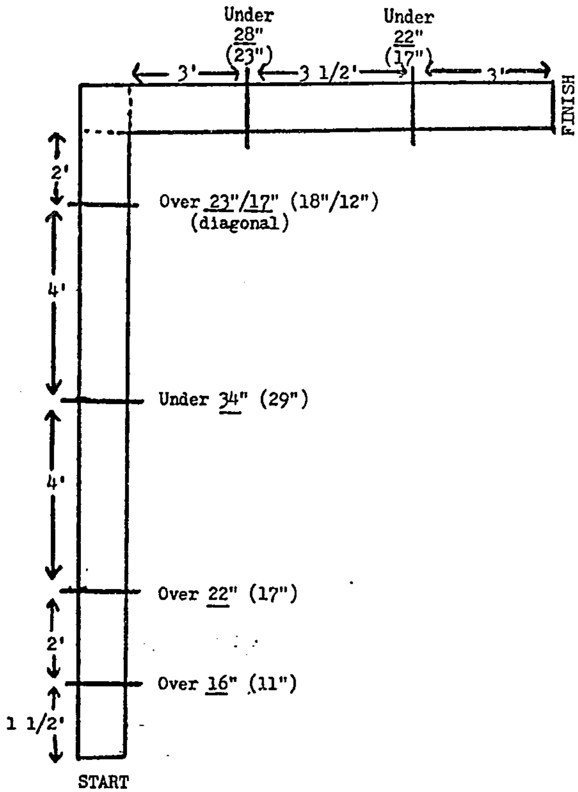
HOPSCOTCH ACTIVITY



BALL ACTIVITY



BEAM ACTIVITY



__" = inches hurdle is above floor

(") = inches hurdle is above beam

INSTRUCTIONS FOR PERCEPTUAL-MOTOR TASKS

SCOOTER ACTIVITY

"There are seven cones on the floor (point to cones). I want you to get on this scooter (point to scooter) and go around every cone like this (walk in and out of first two cones) as quickly as you can. You may get on the scooter any way you want to, except standing. You may not stand on the scooter. The idea is to get from the starting line here (point) to the finish line there (point) as fast as you can, going around the cones, but not touching them, and staying on the scooter (walk through the course while giving final line of instructions).
Do you have any questions?
(Go back to the start, get child and scooter, set it behind the line). I'll say, 'On your mark, get set, go.' When you hear me say go, you may begin. Any questions? Get on the scooter the way you want to now and get ready to start. On your mark, get set, go!"

HOPSCOTCH ACTIVITY

"There are thirteen hoops on the floor (point). I want you to hop from the starting line (point) to the finish line (point), putting one foot in each hoop like this (demonstrate entire course). Go as quickly as you can from the starting line to the finish line, but don't be sloppy--you don't want to step on the hoops (demonstrate), hop two times in the hoops (demonstrate), miss any hoops (demonstrate), or fall out of the hoops (demonstration).
Do you have any questions?
(Go back to the start, child behind the line). I'll say, 'On your mark, get set, go.' When you hear me say go, you may begin. Any questions? Get ready to start. On your mark, get set, go!"

BALL ACTIVITY

"I want you to take this ball and bounce it with one hand, and at the same time, move toward the first hoop on the floor (bounce ball and walk toward hoop). When you get to the hoop, you must bounce the ball 1X inside the hoop and then continue to the next hoop. I'll show you (move from start to 1st hoop, then continue to 2nd hoop). There are six hoops all together, you will start here (point to line) and go through all of the hoops like this (walk child through the course) and end here (point to line). If the ball bounces away from you like this (demonstrate), you may go and pick it up, and then come back to the place where it got away from you. The idea is to get from the starting line to the finish line as fast as you can, bouncing the ball the whole time, and bouncing it only 1X in each hoop. You may not step in or on the hoops during this activity (demonstration). Do you have any questions?
(Go back to the start, ball and child behind line). I'll say, 'On your mark, get set, go.' When you hear me say go, you may begin. Any questions? Pick up (Here's) the ball, get ready to start. On your mark, get set, go!"

BEAM ACTIVITY

"I want you to move across the beam as quickly as you can, and when you come to a hurdle like this one (point) you will go over it or under it, whatever the arrow says to do. (Tester and child walk from hurdle to hurdle). You will go over the first hurdle (show child arrow and motion over w/hand), over the second hurdle (same demo.), you will go under the third hurdle (same), you will go over the fourth hurdle (same), you will go under the fifth hurdle (same) and you will go under the last hurdle (same). You will then go to the end of the beam and step off. You may move across the beam in any way you want to. Remember, you want to get from one end of the beam (point) to the other end (point) as quickly as you can without being sloppy. You don't want to touch the floor or any of the hurdles on the way. Do you have any questions?
(Go back to starting end of beam, child on floor in front of beam)
I'll say, 'On your mark, get set, go.' When you hear me say go, you may begin. Any questions? Get ready to start. On your mark, get set, go! "

[illegible]

Child Code ____________ Date of Testing ________ Tasks: 1st 2nd [illegible]

School ____________ Age ______ Tester ______________ Timer ____________

SCOOTER ACTIVITY 1 2 3 4	Trial 1	Trial 2
Trial 1 Trial 2		
1. Time to complete task.	Raw Time = ____ seconds	Raw Time = ____ seconds
2. Touc cone.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
3. Knocks over cone.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
4. Misses cone.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
5. Falls off scooter.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
6. Goes around in wrong order.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
	Adj. Time = ____ seconds	Adj. Time = ____ seconds

HOPSCOTCH ACTIVITY 1 2 3 4	Trial 1	Trial 2
Trial 1 Trial 2		
1. Time to complete task.	Raw Time = ____ seconds	Raw Time = ____ seconds
2. Touches(steps on)hoop.	____X 1 sec. = ____ seconds	____X 1 sec. = ____ seconds
3. Double hop/jump in hoop.	____X 1 sec. = ____ seconds	____X 1 sec. = ____ seconds
4. Misses hoop.	____X 1 sec. = ____ seconds	____X 1 sec. = ____ seconds
5. Two feet in one hoop.	____X 1 sec. = ____ seconds	____X 1 sec. = ____ seconds
6. Loses balance(steps out of hoop sequence).	____X 1 sec. = ____ seconds	____X 1 sec. = ____ seconds
	Adj. Time = ____ seconds	Adj. Time = ____ seconds

BALL ACTIVITY 1 2 3 4	Trial 1	Trial 2
Trial 1 Trial 2		
1. Time to complete task.	Raw Time = ____ seconds	Raw Time = ____ seconds
2. Touches hoop(w/ball).	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
3. Bounces ball more than one time in hoop.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
4. Misses hoop.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
5. Stops bouncing.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
6. Uses two hands to bounce.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
7. Steps on or in hoop.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
	Adj. Time = ____ seconds	Adj. Time = ____ seconds

BEAM ACTIVITY 1 2 3 4	Trial 1	Trial 2
Trial 1 Trial 2		
1. Time to complete task.	Raw Time = ____ seconds	Raw Time = ____ seconds
2. Touches hurdle.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
3. Knocks off hurdle.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
4. Touches floor.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
5. Over/under at wrong hurdle.	____X 2 sec. = ____ seconds	____X 2 sec. = ____ seconds
	Adj. Time = ____ seconds	Adj. Time = ____ seconds

COMMENTS:	Total Raw Time = ____ seconds	Total Raw Time = ____ seconds
	Total Adjusted Time = ____ seconds	Total Adjusted Time = ____ seconds

APPENDIX E

Table 33

Crossing Midline of Body

Means and Standard Deviations

Group	7	8	Total
Crossing Midline = Right-Hand Only (CML-R)			
	16.33[a]	18.73	17.88
LD	4.80[b]	4.03	4.33
	(6)[c]	(11)	(17)
	21.12	20.42	20.70
NH	2.95	3.92	3.50
	(8)	(12)	(20)
	19.06	19.61	19.40
Total			4.10
	(14)	(23)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 34

Crossing Midline of Body

Analysis of Variance

Source	SS	df	MS	F
Crossing Midline = Right-Hand Only (CML-R)				
Age	6.10	1	6.10	0.40
Group	90.16	1	90.16	5.86
Age by Group Interaction	20.66	1	20.66	1.34
Error	507.31	33	15.37	

* = $P < .05$ $F_{(1, 33)} = 4.15$

Table 35

Crossing Midline of Body

Means and Standard Deviations

Group	7	8	Total
Crossing Midline = Left-Hand Only (CML-L)			
LD	14.00[a]	18.09	16.65
	3.16[b]	3.45	3.82
	(6)[c]	(11)	(17)
NH	18.00	20.58	19.55
	4.84	2.57	3.76
	(8)	(12)	(20)
Total	16.28	19.39	18.22
			4.01
	(14)	(23)	(37)

[a] Mean   [b] Standard Deviation   [c] N

Table 36

Crossing Midline of Body

Analysis of Variance

Source	SS	df	MS	*F*
Crossing Midline = Left-Hand Only (CML-L)				
Age	95.61	1	95.61	7.77*
Group	90.47	1	90.47	7.36*
Age by Group Interaction	4.88	1	4.88	0.40
Error	405.82	33	12.30	

* = $P < .05$ $F_{(1, 33)} = 4.15$

Table 37

Crossing Midline of Body

Means and Standard Deviations

Group	7	8	Total
Crossing Only - Right and Left Hands Combined (CMLX)			
	8.50[a]	15.27	12.88
LD	6.83[b]	4.03	5.99
	(6)[c]	(11)	(17)
	18.62	18.00	18.25
NH	4.00	4.71	4.34
	(8)	(12)	(20)
	14.28	16.69	15.78
Total			5.76
	(14)	(23)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 38

Crossing Midline of Body

Analysis of Variance

Source	SS	df	MS	F
Crossing Only - Right and Left Hands Combined (CMLX)				
Age	81.12	1	81.12	3.56
Group	354.53	1	354.53	15.57*
Age by Group Interaction	117.46	1	117.46	5.16*
Error	751.56	33	22.77	

* = $P < .05$ $F_{(1,33)} = 4.15$

Table 39

Crossing Midline of Body

Means and Standard Deviations

Group	7	8	Total
Right-Hand Crossing to Left Side (CMLX-R)			
	5.50[a]	8.54	7.47
LD	4.04[b]	2.11	3.18
	(6)[c]	(11)	(17)
	10.00	9.33	9.60
NH	1.93	2.81	2.46
	(8)	(12)	(20)
	8.07	8.95	8.62
Total			2.98
	(14)	(23)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 40

Crossing Midline of Body

Analysis of Variance

Source	SS	df	MS	F
Right-Hand Crossing to Left Side (CMLX-R)				
Age	12.14	1	12.14	1.68
Group	60.02	1	60.02	8.29*
Age by Group Interaction	29.58	1	29.58	4.09
Error	238.89	33	7.24	

* = $P < .05$ $F_{(1, 33)} = 4.15$

Table 41

Crossing Midline of Body

Means and Standard Deviations

Group	7	8	Total
Left-Hand Crossing to Right Side (CMLX-L)			
	3.33[a]	7.64	6.12
LD	3.01[b]	3.32	3.77
	(6)[c]	(11)	(17)
	7.38	8.67	8.15
NH	3.29	2.57	2.87
	(8)	(12)	(20)
	5.64	8.18	7.22
Total			3.42
	(14)	(23)	(37)

[a] Mean   [b] Standard Deviation   [c] N

Table 42

Crossing Midline of Body

Analysis of Variance

Source	SS	df	MS	F
Left-Hand Crossing to Right-Side (CMLX-L)				
Age	67.18	1	67.18	7.28*
Group	55.21	1	55.21	5.99*
Age by Group Interaction	19.46	1	19.46	2.11
Error	304.42	33	9.22	

* = $P < .05$ $F_{(1,33)} = 4.15$

Table 43

Standing Balance--Eyes Open

Means and Standard Deviations

Group	7	8	Total
Right-Foot Only (SBO-R)			
LD	19.33[a] 7.99[b] (6)[c]	23.82 19.85 (11)	22.24 16.47 (17)
NH	31.75 42.70 (8)	52.08 43.13 (12)	43.95 43.05 (20)
Total	26.42 (14)	38.56 (23)	33.97 34.91 (37)

[a] Mean [b] Standard Deviation [c] N

Table 44

Standing Balance--Eyes Open

Analysis of Variance

Source	SS	df	MS	$\underline{F}$
<u>Right-Foot Only</u> (SBO-R)				
Age	1322.02	1	1322.02	1.16
Group	3552.22	1	3552.22	3.13
Age by Group Interaction	539.11	1	539.11	0.47
Error	37487.39	33	1135.98	

* = $P < .05$ $\underline{F}_{(1, 33)} = 4.15$

Table 45

Standing Balance--Eyes Open

Means and Standard Deviations

Group	7	8	Total
Left-Foot Only (SBO-L)			
	15.33[a]	18.18	17.18
LD	14.33[b]	14.98	14.37
	(6)[c]	(11)	(17)
	18.75	49.00	36.90
NH	12.43	44.53	37.90
	(8)	(12)	(20)
	17.28	34.26	27.84
Total			30.81
	(14)	(23)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 46

Standing Balance--Eyes Open

Analysis of Variance

Source	SS	df	MS	$\underline{F}$
Left-Foot Only (SBO-L)				
Age	2351.34	1	2351.34	2.97
Group	2515.56	1	2515.56	3.17
Age by Group Interaction	1611.56	1	1611.56	2.03
Error	26168.47	33	792.98	

* = $P < .05$ $\underline{F}_{(1, 33)} = 4.15$

Table 47

Standing Balance--Eyes Closed

Means and Standard Deviations

Group	7	8	Total
Right Foot Only (SBC-R)			
LD	5.67[a] 3.33[b] (6)[c]	4.00 3.95 (11)	4.59 3.72 (17)
NH	2.50 0.92 (8)	10.83 9.31 (12)	7.50 8.25 (20)
Total	3.86 (14)	7.56 (23)	6.16 6.65 (37)

[a] Mean [b] Standard Deviation [c] N

Table 48

Standing Balance--Eyes Closed

Analysis of Variance

Source	SS	df	MS	F
Right-Foot Only (SBC-R)				
Age	265.28	1	265.28	3.59
Group	175.76	1	175.76	2.38
Age by Group Interaction	418.64	1	418.64	5.67*
Error	2438.03	33	73.88	

* = $P < .05$ $\quad F_{(1,33)} = 4.15$

Table 49

Standing Balance--Eyes Closed

Right-Foot Only (SBC-R)

Scheffé *Post Hoc* Test

	x NH-7 2.50	x LD-8 4.00	x LD-7 5.67	x NH-8 10.83
2.50-				*
4.00-				
5.67-				
10.83-				

Table 50

Standing Balance--Eyes Closed

Means and Standard Deviations

Group	7	8	Total
Left Foot Only (SBC-L)			
	3.67[a]	3.91	3.82
LD	1.37[b]	3.27	2.70
	(6)[c]	(11)	(17)
	4.38	8.83	7.05
NH	2.26	7.16	6.05
	(8)	(12)	(20)
	4.08	6.48	5.57
Total			5.02
	(14)	(23)	(37)

[a] Mean [b] Standard Deviation [c] N

Table 51

Standing Balance--Eyes Closed

Analysis of Variance

Source	SS	df	MS	*F*
Left-Foot Only (SBC-L)				
Age	95.39	1	95.39	2.69
Group	28.86	1	28.86	0.81
Age by Group Interaction	214.63	1	214.63	6.05*
Error	1171.00	33	35.48	

* = $P < .05$ $F_{(1,33)} = 4.15$

Table 52

Standing Balance--Eyes Closed

Left-Foot Only (SBC-L)

Scheffé *Post Hoc* Test

	$\bar{x}$ LD-7 3.67	$\bar{x}$ LD-8 3.91	$\bar{x}$ NH-7 4.38	$\bar{x}$ NH-8 8.83
3.67-				*
3.91-				
4.38-				
8.83-				

APPENDIX F

RAW DATA CODE

```
RUN NAME        MEHRMAN STUDY
VARIABLE LIST   SCH,AGE,GRADE,GROUP,TASKS,
                E1SCOOT,E1HOP,E1BALL,E1BEAM,E1TOTAL,
                E2SCOOT,E2HOP,E2BALL,E2BEAM,E2TOTAL,
                SCOOT1WE,HOP1WE,BALL1WE,BEAM1WE,TOTAL1WE,
                SCOOT1NE,HOP1NE,BALL1NE,BEAM1NE,TOTAL1NE,
                SCOOT2WE,HOP2WE,BALL2WE,BEAM2WE,TOTAL2WE,
                SCOOT2NE,HOP2NE,BALL2NE,BEAM2NE,TOTAL2NE,
                SCOOT1E1 TO SCOOT1E5,HOP1E1 TO HOP1E5,
                BALL1E1 TO BALL1E6,BEAM1E1 TO BEAM1E4,
                SCOOT2E1 TO SCOOT2E5,HOP2E1 TO HOP2E5,
                BALL2E1 TO BALL2E6,BEAM2E1 TO BEAM2E4,
                PS1,RACCMAC1,RADJMAC1,LACCMAC1,LADJMAC1,IP1,CML1,CMLX1,RCML1,
                LCML1,
                RCMLX1,LCMLX1,SMC1,RLD1,SBD1,RSBD1,LSBD1,SBC1,RSBC1,LSBC1,A,RL,
                PS2,RACCMAC2,RADJMAC2,LACCMAC2,LADJMAC2,IP2,CML2,CMLX2,RCML2,
                LCML2,
                RCMLX2,LCMLX2,SMC2,RLD2,SBD2,RSBD2,LSBD2,SBC2,RSBC2,LSBC2
INPUT FORMAT    FIXED(2X,2F1.0,3X,5F1.0,F2.0,F1.0,F2.0,2F1.0,F2.0,F1.0,F2.0,
                X,F3.0,3F4.1,F5.1,X,F3.0,3F4.1,F5.1,/
                4F4.1,F5.1,X,4F4.1,F5.1,/
                2X,5F1.0,X,5F1.0,X,F2.0,5F1.0,X,4F1.0,
                3X,5F1.0,X,5F1.0,X,F2.0,5F1.0,X,4F1.0,/
                12F4.1,/,6F4.1,2F2.0,/
                F2.0,4F6.2,9F2.0,3F3.0,3F2.0)
```

ACCORDING TO YOUR INPUT FORMAT, VARIABLES ARE TO BE READ AS FOLLOWS

VARIABLE	FORMAT	RECORD	COLUMNS
SCH	F 1. 0	1	3- 3
AGE	F 1. 0	1	4- 4
GRADE	F 1. 0	1	8- 8
GROUP	F 1. 0	1	9- 9
TASKS	F 1. 0	1	10- 10
E1SCOOT	F 1. 0	1	11- 11
E1HOP	F 1. 0	1	12- 12
E1BALL	F 2. 0	1	13- 14
E1BEAM	F 1. 0	1	15- 15
E1TOTAL	F 2. 0	1	16- 17
E2SCOOT	F 1. 0	1	18- 18
E2HOP	F 1. 0	1	19- 19
E2BALL	F 2. 0	1	20- 21
E2BEAM	F 1. 0	1	22- 22
E2TOTAL	F 2. 0	1	23- 24
SCOOT1WE	F 3. 0	1	26- 28
HOP1WE	F 4. 1	1	29- 32
BALL1WE	F 4. 1	1	33- 36
BEAM1WE	F 4. 1	1	37- 40
TOTAL1WE	F 5. 1	1	41- 45
SCOOT1NE	F 3. 0	1	47- 49
HOP1NE	F 4. 1	1	50- 53
BALL1NE	F 4. 1	1	54- 57
BEAM1NE	F 4. 1	1	58- 61
TOTAL1NE	F 5. 1	1	62- 66
SCOOT2WE	F 4. 1	2	1- 4
HOP2WE	F 4. 1	2	5- 8
BALL2WE	F 4. 1	2	9- 12
BEAM2WE	F 4. 1	2	13- 16
TOTAL2WE	F 5. 1	2	17- 21
SCOOT2NE	F 4. 1	2	23- 26
HOP2NE	F 4. 1	2	27- 30
BALL2NE	F 4. 1	2	31- 34
BEAM2NE	F 4. 1	2	35- 38
TOTAL2NE	F 5. 1	2	39- 43
SCOOT1E1	F 1. 0	3	3- 3
SCOOT1E2	F 1. 0	3	4- 4
SCOOT1E3	F 1. 0	3	5- 5
SCOOT1E4	F 1. 0	3	6- 6
SCOOT1E5	F 1. 0	3	7- 7
HOP1E1	F 1. 0	3	9- 9
HOP1E2	F 1. 0	3	10- 10

VARIABLE	FORMAT	RECORD	COLUMNS
HOP1E3	F 1. 0	3	11- 11
HOP1E4	F 1. 0	3	12- 12
HOP1E5	F 1. 0	3	13- 13
BALL1E1	F 2. 0	3	15- 16
BALL1E2	F 1. 0	3	17- 17
BALL1E3	F 1. 0	3	18- 18
BALL1E4	F 1. 0	3	19- 19
BALL1E5	F 1. 0	3	20- 20
BALL1E6	F 1. 0	3	21- 21
BEAM1E1	F 1. 0	3	23- 23
BEAM1E2	F 1. 0	3	24- 24
BEAM1E3	F 1. 0	3	25- 25
BEAM1E4	F 1. 0	3	26- 26
SCOOT2E1	F 1. 0	3	30- 30
SCOOT2E2	F 1. 0	3	31- 31
SCOOT2E3	F 1. 0	3	32- 32
SCOOT2E4	F 1. 0	3	33- 33
SCOOT2E5	F 1. 0	3	34- 34
HOP2E1	F 1. 0	3	36- 36
HOP2E2	F 1. 0	3	37- 37
HOP2E3	F 1. 0	3	38- 38
HOP2E4	F 1. 0	3	39- 39
HOP2E5	F 1. 0	3	40- 40
BALL2E1	F 2. 0	3	42- 43
BALL2E2	F 1. 0	3	44- 44
BALL2E3	F 1. 0	3	45- 45
BALL2E4	F 1. 0	3	46- 46
BALL2E5	F 1. 0	3	47- 47
BALL2E6	F 1. 0	3	48- 48
BEAM2E1	F 1. 0	3	50- 50
BEAM2E2	F 1. 0	3	51- 51
BEAM2E3	F 1. 0	3	52- 52
BEAM2E4	F 1. 0	3	53- 53
PS1	F 4. 1	4	1- 4
RACCMAC1	F 4. 1	4	5- 8
RADJMAC1	F 4. 1	4	9- 12
LACCMAC1	F 4. 1	4	13- 16
LADJMAC1	F 4. 1	4	17- 20
IP1	F 4. 1	4	21- 24
CML1	F 4. 1	4	25- 28
CMLX1	F 4. 1	4	29- 32
RCML1	F 4. 1	4	33- 36
LCML1	F 4. 1	4	37- 40
RCMLX1	F 4. 1	4	41- 44
LCMLX1	F 4. 1	4	45- 48
BMC1	F 4. 1	5	1- 4
RLD1	F 4. 1	5	5- 8
SED1	F 4. 1	5	9- 12
RSBD1	F 4. 1	5	13- 16
LSBD1	F 4. 1	5	17- 20
SEC1	F 4. 1	5	21- 24
RSBC1	F 4. 1	5	25- 28
LSBC1	F 4. 1	5	29- 32
A	F 2. 0	5	33- 34
RL	F 2. 0	5	35- 36
PS2	F 2. 0	6	1- 2
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RADJMAC2	F 6. 2	6	9- 14
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LADJMAC2	F 6. 2	6	21- 26
IP2	F 2. 0	6	27- 28
CML2	F 2. 0	6	29- 30
CMLX2	F 2. 0	6	31- 32
RCML2	F 2. 0	6	33- 34
LCML2	F 2. 0	6	35- 36
RCMLX2	F 2. 0	6	37- 38
LCMLX2	F 2. 0	6	39- 40
BMC2	F 2. 0	6	41- 42
RLD2	F 2. 0	6	43- 44
SED2	F 3. 0	6	45- 47
RSBD2	F 3. 0	6	48- 50
LSBD2	F 3. 0	6	51- 53
SEC2	F 2. 0	6	54- 55
RSBC2	F 2. 0	6	56- 57
LSBC2	F 2. 0	6	58- 59

RAW DATA

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