A CASE STUDY OF CHILDREN PARTICIPATING
IN A PERCEPTUAL-MOTOR PROGRAM

by

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ABSTRACT

The purpose of this study was to provide a description of the physical performance of a group of slow learning children who participated in a perceptual-motor program and to observe the effects of special training in motor skills on the visual perception and motor capacity of each child.

Eight subjects, ranging in age from six to nine years, were selected to participate in the study. Each subject was referred to the program because of a diagnosis of retarded perceptual-motor development.

The subjects were given pre-training standardized tests in General Motor Capacity and Visual Perception. They then received approximately fifty minutes of daily instruction in motor skills for a total of sixty-five days. At the conclusion of the special training period, the subjects were once again tested in general motor capacity and visual perception. The scores on the initial and final tests in motor capacity and perceptual ability were compared and the differences were recorded.

A case study was conducted on each subject in order to obtain as much information as possible on each individual participating in the program. Information was obtained from medical and school records, psychologist and teacher reports, and the detailed observations of the investigator.
The results indicated that difficulties in differentiation, balance and coordination appeared to be characteristic of the child having inadequate perceptual-motor development. A comparison of pre- and post-training test results showed that an improvement in motor capacity and visual perception occurred in all the subjects. Marked improvements were also observed in the children's behavior and attitude. From the findings of this study it appears that a special motor training program is a major contributor to the overall rehabilitation of the perceptually-motor handicapped child.
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CHAPTER I

STATEMENT OF THE PROBLEM

During the past decade a great deal of concern has been shown about children, who, for a variety of reasons, are unable to function efficiently in the mainstream of education and require a special program to meet their particular needs. Psychologists, physicians, and educators have identified one of the major problem areas as deficient perceptual-motor development.

Inadequate visual perception and motor ability have been shown to be two interrelated factors which make learning very difficult if not impossible (49). Programs to aid the perceptual-motor handicapped child must consider the complex perceptual-motor responses which occur concomitantly in the child. "Inadequate motor responses may be obstructing perceptual learning, and perceptual training may be difficult or impossible in the face of such motor inadequacy" (49:III).

The perceptual-motor process includes both input (sensory or perceptual activities) and output (motor or muscular activities). "A division of the two is impossible, for anything that happens to one area automatically affects the other. Any total activity includes input, integration,
output, and feedback" (49:136).

Many children of average or near average intelligence are handicapped in their intellectual, emotional, and physical development because of inadequate perceptual-motor development. Children having a perceptual-motor disturbance have a gross tendency to interpret stimuli incorrectly and to perform physical activities in an inefficient manner. The causes of inadequate perceptual-motor development can be classified as genetic, trauma, or lack of environmental opportunity. It has been estimated that inadequate perceptual-motor learning experiences accounts for sixty per cent of perceptual-motor problems (23).

Leaders in the perceptual-motor area such as Kephart (48) and Frostig (32) indicate that many children enter our school systems lacking necessary perceptual-motor development. Frostig (32) estimates that approximately ten to fifteen per cent of all children display learning difficulties of some kind, without showing a lack of intelligence. Both Kephart (48) and Frostig (32) maintain that the most frequent cause of these learning difficulties, and perhaps the least recognized, is a disturbance of the child's visual perception. Without adequate perception the child is isolated from his environment.

Accompanying a disturbance in perceptual development as a major cause of learning difficulty, is inadequate motor coordination. Children who exhibit learning problems in the lower grades may often have retarded motor development.
Kephart and Radler (61) have based their remedial and school readiness programs upon the development of motor coordination and eye movements. Without adequate motor coordination, a child is handicapped not only on the playground but may also be retarded in all his learning. Getman (37) indicates that the foundation of every intellectual activity of the human being is the attainment of motor control and coordination.

Numerous studies have indicated that perceptual-motor difficulties are related to problems of school achievement (54) (68) (72). The educational implications of perceptual-motor training imply that the child often labelled as the slow learner, immature, or emotionally disturbed, may be returned to a normal class situation after he has attained adequate perceptual-motor development. In their remedial programs, Kephart (48) and Frostig (32) stress the importance of "gross motor bases" in the development of the child. It is believed that the young child proceeds along a definite sequence of perceptual-motor learning, and that all subsequent learning is built on these early experiences.

The purpose of this study was to observe the effects of special training in motor skills on the visual perception and motor ability of young children. It was anticipated that after having participated in the program the subjects would be able to return to a normal class situation. A case study approach was adopted so as to provide a detailed
account of each subject. Information on the subjects was obtained from school and medical records, teachers' and parents' comments, and the investigator's observations.

The case study findings are subject to possible limitations. Certain factors which limit the interpretation of the results are:

1. absence of a control group,

2. possible effect of extraneous influences such as home environment and special motivation, and

3. no control for the Hawthorne effect.
CHAPTER II

REVIEW OF THE LITERATURE

Perceptual Development

All learning may be considered as the adjustment of responses to stimuli or to stimulus situations. However, before one can make the appropriate response, he must perceive (recognize) the stimulus. Even though these recognitions may be subliminal at times, there must be familiarity with the stimulus in order for an appropriate response to be made. This recognition of stimulus or stimulus situations is called "perception".

Motor learning has often been referred to as perceptual-motor learning because before an individual can respond appropriately he must recognize the stimuli. The recognition as well as the adaptive action has to be learned. Lawther (52:42) indicates that the recognition of the "stimulus pattern" constitutes a great part of our learning, and seems to increase in importance as we progress up the hierarchial scale of learning complexity and maturity:

"Early in childhood we learned to recognize sensations of slight loss of balance and to respond appropriately. Perceptions, once learned, are automatic responses to specific types of stimuli. They are the synthesis of the incoming stimuli and the associated experiential
background already programmed into one's nervous system. The response may be merely a feeling of familiarity, our awareness of meaning, or even a subliminal but completely adapted motor response."

Perception has primarily been investigated as a sense-orientated phenomenon with studies divided into compartments called visual perception, auditory perception, tactual perception and so on (52). However, most emphasis has been placed on the investigation of visual perception. Frostig (33:463) indicates that disturbances in visual perception were by far the most frequent symptoms observed in children who were referred to the Marianne Frostig School of Educational Therapy. Barsch (6:169) supports Frostig's findings on the high incidence of retarded visual perception among children and stresses that researchers often misinterpret perceptual disturbances:

"Much of the literature on "perceptual disturbances" has resulted from the study of single performances or even a series of performances resulting in a conclusion that the individual subject suffered from a generalized perceptual inefficiency. Unfortunately this type of investigation has led to wholesale generalizations about the individual's perception. Failures in visual perception in no way permit a generalization about the totality of an individual's perceptual efficiency. Similarly, failures on any given perceptual task do not warrant summary conclusions about his total performance."

The effect of a perceptual disturbance upon the totality of performances in an individual's daily experience has not yet been detailed. What is usually meant by the term "perceptual disturbance" is the gross tendency of the performer to perceive in ways other than those appropriate.
The perceptually handicapped individual distorts what he sees and acts in accord with this mis-interpretation.

Gibson and Olum (6:346) reviewed experimental studies and methods of studying perception in children. They suggested that the description of perceptual development in children has not received the same careful attention as the area of vision or motor patterns. They stated that most perceptual theorists have concentrated on adult populations, occasionally applying the same techniques to the study of children in an attempt to give some developmental perspective to their theories.

Gibson and Olum (38) identify Piaget as one of the few investigators who has provided landmarks to guide researchers in building an integrated picture of perception. Piaget (60) described three types of spatial stages which occur for the child. During the first two years of life, usually defined as the sensory-motor period, events occur in space which have relatively minor perceptual value to the infant. They serve the primary purpose of stimulating the child's touch, kinesthesia, vision, audition, smell, and taste. In the initial stage which Piaget terms "practical space", there is a one-to-one relationship to objects. One object is associated with one look, one sound, one touch, and one effort. Any object out of reach is spatially "gone".

This is followed by searching, groping efforts to "follow" an object out of reach with hands initially undirected
by eyes but eventually coming under visual control. This second stage is a trail-and-error or "empirical space" in which any form of hiding still causes the object to disappear from the infant's space world. The curiosity here gradually brings the infant to the "container period" of putting in and taking out. By the end of the first two years, he has acquired the primitive fundamentals of the "objective" world of space and is beginning to understand the spatial relations of up, down, in, out, and in front of.

Barsch (6:141) relates Piaget's observations of perceptual development to the perceptually impaired child. This child's relationship to space is unorganized and defined only in terms of "action". He is in "practical space" - engaged in meaningless action whether he is two years of age or twelve. The perceptually handicapped child remains in "practical space" where objects are present only to satisfy activity. The objects bear no relationship to one another. Each is there only for the child to act upon, without concern for the inter-relatedness which exists.

Ayres (s:742) states that increasing the handicapped child's visual perception is the basis for his rehabilitation. "In order to respond to the environment purposefully and motor plan effectively in relation to it, one must first be able to interpret it."

After having gathered information on numerous studies concerned with the implications of visual perception to the
adaptive program, Smith (69:30) referred to the historical background of perception and indicated how previous theories have been incorporated into many of the principles of developmental programs:

"The foregoing outline of a few selected and pertinent psychological theories about perception and its interrelationships with sensorimotor experience serves to illustrate that the theoretical constructs which have acted as a basis for the motor programs currently being employed in alleviating learning disabilities are not entirely new. Rather these theories make use of several philosophical positions."

Numerous investigators have conducted programs which prepared the child for later, more highly complex learning, by providing the perceptual and motor development which is a necessary prerequisite for future learning (48) (32) (23) (71). It has been indicated by these researchers that through training in perceptual-motor development, many of our slow learners will be able to achieve greater success in their school experiences.

Research has shown that the "figure-ground" component of visual perception is the area in which special attention usually must be given in remedial programs. Cratty (17:95) states that "one of the central factors which influences perception relates to the manner in which we select central objects from their background and our relative dependency upon the central figure, or its surroundings when making perceptual judgments".

Differences in figure-ground perception were found between three groups of children seven to ten years of age
in a study conducted by Werner and Strauss (76). These three groups were: normally intelligent, endogenously retarded, and exogenously retarded. The exogenously retarded group was markedly more ground-orientated than both the other groups.

Studies by Frostig and Horne (32) have identified inadequate figure-ground perception to be the most frequent perceptual disturbance among children. By showing that visual perception was composed of not one, but several abilities, they pointed out that a child may have disturbances of visual perception but possess excellent figure-ground discrimination. Conversely, he may be severely handicapped by poor figure-ground discrimination but perform well in other areas of visual perception.

In a recent study, Gallahue (34) randomly selected eighty kindergarten children ranging in age from five years, five months, to six years, five months, and administered the Figure-Ground subtest of the Frostig Test and a gross motor task which involved walking in a lateral direction between the rungs of a ladder placed in a horizontal position over a floor pattern. The results indicated that as the figure blends more with the background, and as the figure and ground patterns become more distracting, adequate performance of the locomotor movement task diminishes. Gallahue (34:952) concludes that "figure-ground perceptual ability is an important aspect of a kindergarten child's
ability to perform a gross motor task accurately".

The Frostig Developmental Test of Visual Perception

Several investigators have stated that the Frostig Developmental Test of Visual Perception is the most accurate measure of a child's perceptual development (24)(33). The purpose of the test, as described by Frostig (33), is to detect those children whose perceptual abilities are retarded in comparison with the norm.

The five subtests of this battery were designed to evaluate five relatively independent areas of development. These areas are described by Frostig as: (a) eye-motor coordination to identify children who have difficulty writing; (b) figure-ground perception to identify children who have difficulty in identifying words; (c) form constancy to identify children who are unable to recognize a letter or word when it is written in different sizes or colours; (d) position in space to identify children who reverse or rotate letters or words in "mirror writing"; (e) spatial relationships to identify children who interchange the order of letters in a word.

Deficiencies in one or more areas of visual perception during the primary grades can make learning a very difficult, if not impossible task. The .441 correlation found between teacher ratings of classroom adjustment and scores on the Frostig Test suggests the correctness of the hypothesis that disturbances in visual perception during the early school
years are likely to be reflected in disturbances in classroom behavior (33:492).

The current (third) edition of the Frostig Test (33:498) was standardized on more than 2,100 children. The test-retest reliability was .80. Validity was determined by correlation studies (70).

Frostig's detailed investigations of visual perception indicate that between the ages of three and one-half and seven and one-half years, visual perception is a major developmental task for the child (33:492). After seven years of age, the child becomes more independent of immediate perceptions as he learns to link events of the past with the present and future and to develop causal thinking. However, clinical studies show that children with severe perceptual disturbances are often unable to overcome their perceptual handicaps. These children often continue to require remedial attention if academic progress is to be maintained.

**Motor Development**

For many years, workers in the field of child development have identified stages in the growth and development of children. It is customary to talk of sequences of development in many areas of the child's activity. Elaborate normative studies have revealed the age at which specific activities can normally be expected to appear (49:3). During the last decade a great deal of emphasis has been given to what is probably the most basic of all the areas of
development in the child--perceptual-motor development.

Research has indicated that numerous physiological and psychological problems may occur during the developmental period which interfere with the establishment of a stable perceptual-motor world (31:405). Leaders in the perceptual-motor field such as Kephart (48) and Frostig (32) have recognized that a significant number of children enter our school systems lacking the fundamental assumptions which underlie so much of the material which is presented. For these children, classroom learning may cause difficulty, "not because of the content, but because of inability to deal with the perceptual-motor mechanics of the presentation" (31:406).

The influence of motor development on learning has been substantiated by numerous studies in the literature. Kephart (48) has provided a vast amount of information in this area during the last twenty-five years. Kephart emphasizes the dependence of all learning on the early motor learning stage of development:

"The child's first interactions with his environment are motor. His first learnings are motor learnings. His first attempts to organize the environment are based upon these motor interactions. For a very large number of children, the learning difficulty begins at this early motor stage. He learned to use his motor responses to accomplish certain ends, but he failed to expand or generalize these motor responses so that they formed the basis of information gathering. He has learned a motor response for a specific end, but has not developed a motor interaction with his environment." (31:406)
Kephart's rationale, which is based largely upon clinical observation, forms the basis of numerous therapy programs. According to Kephart (31) the child must maintain a consistent, uninterrupted interaction with his environment and this can only be achieved through locomotor patterns. The motor patterns which are essential for information gathering at this basic early stage in the development of the world of the child are four in number:

1. Balance and Maintenance of Posture
   - by maintaining the relationship of his body to the force of gravity, the child identifies the direction of the line of gravity and maintains this constant throughout his interactions with the environment.

2. Locomotion
   - it is within the pattern of locomotion that the child investigates the relationship within the space around him. By moving his body from one point to another, he learns to appreciate the properties of this surrounding space and the relationships between the objects in it.

3. Contact
   - it is with the contact skills that the child investigates through manipulation the relationships within objects. In order to obtain this information he must be able to reach out and
make contact with the objects; he must be able to maintain this contact through grasp until he has obtained the necessary information, and he must be able to terminate this contact through release and move on to the next object. From the knowledge so gained, form perception and figure-ground relationships will develop.

4. Receipt and Propulsion

-it is with the skills of receipt and propulsion that the child investigates movements in space. Receipt skills involve those activities by which the child makes contact with a moving object. The skills of propulsion involve those activities by which the child imparts movement to an object.

In summarizing the needs of the perceptually-motor handicapped child, Kephart (31:409) indicates the main objective of the perceptual-motor program:

"Many children find the motor learning required for a learning pattern difficult. As a result, they stop with a motor skill. They require additional help and additional learning experiences to continue this motor learning until a level is reached which will permit the use of movement, not only for specific purposes, but for the more generalized purpose of information gathering. It becomes the responsibility of the public schools to offer this aid and to help the child expand his motor learning."

Many observational studies of children report that inadequate stimulation and experience hinder the learning process (52:23). Apparently a considerable quantity of varied experiences is essential to many kinds of learning.
Deprivation studies in which subjects are restricted greatly in stimulation have been found to produce rapid deterioration of physical and intellectual performance (52). Anderson (52:23) has hypothesized that the child's learning is due chiefly to "a high input and a high outgo", a flow of stimulation and response in which "...single experiences or elements occupy relatively insignificant parts". According to Anderson, learning is determined by the relative proportions of different types of stimulation and the amount of reinforcement that occurs.

Within recent years research has been increasingly concerned with a more comprehensive approach to understanding motor performance (66) (17). Cratty (17:26) indicates that "while the motor output seemed to be the first aspect of performance drawing the attention of researchers, within the past several years the types of sensory cues influencing performance, as well as the formation of meanings from sensory experience (the process of perception) have been studied in greater detail". Thus the term "perceptual-motor" has been coined, indicating the important influence the sensory cues and the perceptual process have upon the motor act.

Lawther (52) supports Cratty's views on the relationship between perception and motor activity. He indicates that the learning of perceptual-motor patterns such as running, jumping and throwing involve adjustments in terms
of perception. Any skill demanding steadiness and fineness of control such as a balancing activity, requires much inhibition of movement. Precision in perception and constant feedback of perceived information are essential for these types of activities.

Perceptual-motor activities form the basis of many remedial programs designed for slow learning children. Radler and Kephart (61:24) emphasize the importance of basic motor skills in the intellectual development of the child:

"Each movement made by a developing child is in itself an experience which contributes to the basic store of information held by the brain. In other words, movements are not only output; they are input as well. What a child does today affects what he will be able to do tomorrow. All behavior is movement of one kind or another and that the movements made by a developing child constitute learning units that contribute to his total store of knowledge."

Through his early motor explorations, the child begins to find out about himself and the world around him. His motor experimentation and his motor learnings become the foundation upon which such knowledge is built. From his studies of child development and learning, Jersild (48:35) has indicated that in early childhood, mental and physical activities are closely related. He maintains that motor activities play a major role in intellectual development. Kephart (48:35) supports Jersild, stating, "To a large extent, so-called higher forms of behavior develop out of and have their roots in motor learning."

Several studies have indicated a relationship between
achievement in reading and achievement in selected motor skills among children (59) (54) (72). Plack (59) administered the Iowa Test of Basic Reading Achievement and the Johnson Motor Achievement Battery to one hundred seventy-two subjects selected from grades ones, three and five. The conclusions of her study indicated high positive relationships between achievement in selected reading evaluations and selected motor skills. Mean motor skills were significantly different among high, middle and low reading achievement groups. Highly significant correlations were found to exist between achievement in reading and the throw and catch test and achievement in reading and the zig-zag run test.

Welch (75) investigated the effects of a special program in motor activity (based on Kephart) on the reading ability of a group of grade one children who were all poor readers. After sixteen weeks, the group receiving special motor training was shown to be superior to a control group which received no special training. Improvements were also observed in general motor capacity.

Trussell (72) studied the relationship between performance scores in reading achievement, visual perception, two perceptual-motor tasks and eye-hand dominance in seventy-five first and second grade children. Correlations among many variables were significant although none were high enough for reliable prediction of one variable from another.

Investigation of the influence of laterality and directionality on reading ability has produced conflicting
results. Kephart (48:49) maintains that laterality and directionality, the two major "coordinates of the child's motor learning", must be developed before the child is able to attain orientation in space and to observe the relationship between objects in space. Laterality may be defined as the sense of one's symmetry, of leftness and rightness. Directionality is laterality projected into space, which is obtained through and experienced in motor skills.

Several researchers (23) (32) support Kephart's findings that many poor readers lack basic motor skills which can be made up if they are taught. Delacato's (23) concept of "neurological organization" attempts to explain deficits in reading readiness and to show how a child first develops physically and then intellectually. Contrary to Kephart's views, Delacato states that the most important element for successful reading is cortical hemispheric dominance, or one-sidedness. He believes that lack of complete and constant laterality results in reading and language problems. From his observations, Delacato states that sixty to eighty per cent of the superior readers are completely one-sided. Delacato's theories and findings have received heavy criticism from researchers in various fields.

Singer (66:141) indicates that a number of recent studies have not found any difference in reading ability between established and non-established laterality groups.
Capobianco (11), for example, administered five tests of handedness and four tests of eyedness to subjects with special learning disabilities. The test scores were then correlated with reading ability measures. Results indicated that lateral dominance did not facilitate reading achievement; in fact, incomplete dominance, in certain cases, accompanied better reading performance.

A great deal of interest is currently being shown towards the relationship of motor ability and intellectual achievement (66). Recent efforts by Ismail (45) suggest that motor coordination items are highly related to academic achievement. He has obtained success in utilizing coordination tasks and balance tasks as predictors of intellectual achievement. Interestingly enough, the subjects have been as old as pre-adolescents.

By providing activities which encourage the development of motor abilities such as coordination and balance, many remedial programs aid in the rehabilitation of the slow learner. A study recently conducted by Fretz, Johnson and Johnson (30) measured the perceptual-motor development of children participating in a remedial program. Standardized tests of perceptual and motor ability were administered to fifty-three children enrolled in an eight week physical developmental clinic and to thirty-one applicants who were waiting to enroll when space was available. The children studied were referred for reasons of poor coordination and emotional and social maladjustment. A comparison of pre- and
post-clinic test performance of the participating children, compared to the test-retest performance of the "wait-list" controls indicated that participants made significant improvements in all perceptual and motor measures and in performance I.Q.

The Carpenter General Motor Capacity Test

The Carpenter General Motor Capacity Test is one of the few motor tests available for young children. Designed by Dr. Carpenter specifically for children in the lower elementary grades, the total score (GMCS) obtained, may be used as a measure of the child's motor capacity.

According to McCloy (15:271), motor capacity depicts innate or inherent motor potentialities—the level which an individual may be expected to attain. In this respect, the General Motor Capacity Test may be compared to an intelligence test as it is not designed to measure present developed ability in any one activity.

In light of recent findings on the interpretive and predictive values of intelligence test scores, the investigator suggests that caution must be taken when attempting to employ capacity tests for predictive purposes. General Motor Capacity Scores, like intelligence scores, are not constant and significant improvements can occur as a result of special training.

Since the original General Motor Capacity Test proved to be very successful as a useful measure of general motor
capacity in the upper grades and high school, Carpenter developed comparable standards for the first three grades. After two preliminary studies, she completed the final General Motor Capacity Test which has reliability of .7281 for girls and .7398 for boys (33).

Although interest and investigation in the area of perceptual-motor development has increased during the last two decades, many unanswered questions remain. It must be emphasized that more knowledge and research are required about the neural basis of movement behavior and the inter-relationship of motor activity and perception. The investigator was unable to locate any studies in the literature which provided a detailed description of the physical performance of children participating in a perceptual-motor program.

It was with the belief that the perceptual-motor training is a very important contributing factor in the improvement of both physical and academic performance of the slow learning child, that this research was conducted.
CHAPTER III

METHODS AND PROCEDURES

During the month of November, 1969, eight children displaying obvious learning disabilities within the normal school situation were referred to Dr. E. N. Ellis, Assistant Director of Research and Testing for the Vancouver School Board, for individual assessments. The children, all attending Sir Alexander MacKenzie Elementary School, ranged in age from six to nine years. Although differing in age, all were similar in that their overall academic achievement was at least one year behind their age level. Because inadequate perceptual-motor development was identified as the major factor in their learning disability, it was recommended that the children be placed in a perceptual-motor program.

In consultation with Mr. C. W. McLachlan, principal of Sir Richard McBride Elementary School, and Mrs. E. Sharpe, the remedial teacher, it was decided that the facilities of the Perceptual-Motor room of McBride School would be utilized in the program.

The Frostig Developmental Test of Visual Perception (32) was administered to each subject by Miss J. Moody, a
psychologist for the Vancouver School Board. Scoring on the test is objective. The child's raw scores for each sub-test were converted to a perceptual age equivalent, representing the age at which the average child achieves this score. The five perceptual age levels and the five scale scores (one for each of the sub-tests) indicate the child's development in each visual perception ability. The total perceptual quotient (P.Q.) was derived for each subject. The perceptual quotient is a deviation score obtained from the sum of sub-test scale scores after correcting for age variation.

On January 4, 1970, the six male subjects and two female subjects selected for this study, became participants in the perceptual-motor program. The children received fourteen weeks of special training in gross motor and fine motor activities for approximately one hour a day, five days a week. A brief description of the types of activities and equipment used in the program is outlined in Appendix A of this report.

All of the special training periods were conducted in the Perceptual-Motor room at McBride School. The subjects were transported to the program from Sir Alexander MacKenzie, a neighbouring elementary school. The writer alternated the days of instruction with Mr. D. Miscisco, a graduate student in Physical Education at the University of British Columbia. Remedial work in reading was given to the children
by their classroom teacher. The only remedial work in motor training was provided by the investigator.

The Carpenter General Motor Capacity Test

During December, 1969, before the program of special training began, the Carpenter General Motor Capacity Test was administered to each subject. The test was not designed to measure present developed ability in any one activity, but to predict potential levels that the individual may be expected to attain. The following test items, together with the elements they purport to measure, compose this test (53:271):

(i) Classification Index \((\text{age} \times 20 + \text{height} \times 6 + \text{weight})\)
- general size and maturity

(ii) Sargent Jump (the distance in centimetres between the top of the reach mark and the top of the highest jump mark)
- "explosive" power of the large muscles

(iii) Squat-Thrust (total number completed in ten seconds)
- agility, the ability to change the direction of the body very rapidly

(iv) Iowa-Bracé Test (consisting of six stunts suitable for children of the first three grades)
- inherent motor skill

Following are the Regression Equations for computing the general motor capacity (GMC) of children in the first three grades of elementary school.
Boys
GMC = 0.181 (Classification Index) + 0.769 (Sargent Jump in cms.)
+ 0.510 (Brace Test score) + 2.187 (Squat-thrust) - 62.

Girls
GMC = 3.576 (Sargent Jump in cms.) + 2.20 (Brace Test score)
+ 19.12 (Squat-thrust) + 29.

The correlation of the final weighted batteries with the ratings made by experienced instructors was .51 for boys and .73 for girls (15:271).

The Motor Quotient (M.Q.)

The GMCS, when divided by the norm for the subject, expresses his capacity as a percentage of the norm or M.Q. This quotient is the motor analogue of the I.Q. score used in the measure of intelligence.

Administration of the Carpenter General Motor Capacity Test

The Carpenter General Motor Capacity Test was administered in the following manner:

1. Each subject was weighed and measured for height, using the equipment in the Health Room at the McBride School. Weights (to the nearest one-half pound) and heights (to the nearest one-half inch) were recorded. The subjects were barefooted and wore gym clothing.

2. Each subject was tested individually in the Sargent Jump test, the Squat-thrust test, and the Iowa-Brace test. The other members of the group were not permitted
to witness this phase of the testing before participating in the tests.

3. Each part of the Carpenter Test was demonstrated to the subject. The subject was then permitted two practice trials to be certain that he understood the test and how to perform it. These practice trials also served as a warm-up for the subject.

4. The subject was allowed three official trials in the Sargent Jump test. The highest jump mark attained in the three trials was then recorded.

5. For the Squat-thrust test, only one official trial was allowed. A stop-watch was used to time the trial. The total number of squat-thrusts was recorded.

6. The Iowa-Brace test consists of six motor ability stunts. Each stunt was demonstrated to the subject by the instructor. The subject was then allowed one practice try. Two official trials were allowed. The six stunts included in this test are as follows:

(i) **Grapevine** - consists of standing on both feet in a full squat position, placing arms between the legs and around the knees so that fingers touch in front. Position must be held for a minimum of five seconds.

(ii) **One-Knee Balance** - subject balances on one knee with other leg held straight back and off the floor; arms held out to sides; position must be held for five seconds.
(iii) **Cross-Leg Squat** - from cross-leg sitting position, arms folded across chest, subject rises to standing position on sides of feet without losing balance or moving feet.

(iv) **Hop Backward** - the subject balances on one foot, closes eyes, takes five hops (on the same foot) backward; subject must hold position of balance (with eyes closed), after completing final hop, for five seconds; failure results if subject opens eyes too soon or touches other foot to floor or falls over before completion of test.

(v) **Half-turn Jump** - balanced on one foot, subject is required to jump off the balance foot, complete a 180 degree turn, and land on the same foot; losing balance, touching other foot to floor, or failing to execute a complete turn constitutes a failure on this test.

(vi) **Kneel-Jump to Feet** - from a kneeling position, toes pointed straight behind, and arms held out to side (subject was permitted to swing the arms), the subject was required to jump to a standing position without moving the feet or "rocking" back on the balls of the feet.

**Case Study Reports**

In order to provide as much information as possible on each subject, the investigator studied the school and medical
records of each child. Pertinent information received from these sources as well as from parents' and teachers' comments was recorded and included in the case study reports.

A detailed record was kept showing each child's physical performance throughout the program. This record indicated the specific motor characteristics of each subject.

Kephart's Observations of Basic Motor Movements

Kephart's "Observations of Basic Motor Movements" formed the basis for the case study information of the child's motor performance. In order to better assess the particular individual perceptual-motor abilities and needs of each subject, each child was given a series of motor performance tasks to perform at the beginning and throughout the program. These tasks, devised by Kephart (49), permitted an informative observation of the child's perceptual-motor behavior. They were designed to elicit behavior indicative of ability in the areas of differentiation, balance, and coordination.

Tasks involving differentiation, indicated the child's ability to sort out and use independently, in a controlled manner, different parts of his body. Differentiation movements involving the head, trunk, and limbs were performed while the subject was lying on his back or stomach. As an example, arm differentiation would be observed by having the subject lie on his back and move his arm as directed. The resulting movements showed the child's ability to innervate the muscles of one arm without innervating in a similar
fashion, the muscles of the other arm or any of the parts of the body not required by the task.

Balance and coordination was assessed by the subject's performance of tasks involving various movements and positions of the body. Observations were based on the manner in which each child sat, stood, crawled, walked, ran, and changed from one type of movement to another. By observing the movements required for a child to change from a standing to a lying down position, information was obtained regarding the child's balance and coordination. Also postural faults became obvious. An informing balancing task required the subject to stand still for thirty to sixty seconds. Observations were made regarding swaying from side to side and shifting the weight from one foot to another.

Information concerning each subject's coordination was obtained by observing the child as he ran or walked on command. After asking the child to walk sideways backwards, the investigator observed faults such as difficulty in initiating for stopping the movement, difficulty maintaining the movement or direction, and being unable to maintain the lead with one foot.

The nature of the tasks permitted observation and assessment of the child in a relatively short period of time and without the use of complicated devices and apparatus. The results obtained from the "Observations of Basic Motor Movements" aided the investigator in selecting appropriate
training activities which could correct or improve the specific inadequacies of each subject. They also provided important information for the case studies. The investigator recorded the differences which occurred in each child's performance of Kephart's tasks from the beginning to the end of the program, thus noting any improvements.

At the completion of fourteen weeks, the subjects were given the final Frostig Developmental Test of Visual Perception and the Carpenter General Motor Capacity Test. The results of these two tests were tabulated and compared with the results of the tests that were conducted at the beginning of the study. A summary of these results may be found in Chapter IV of this report.
CHAPTER IV

RESULTS AND DISCUSSION

The results of this study are provided in the form of tables and case study reports. As the data did not lend itself to statistical analysis, it was decided to present the initial and final Perceptual Quotient (P.Q.) and Motor Quotient (M.Q.) scores. A comparison of results between each subject's initial and final scores may serve as an indication of changes which have occurred in his ability.

Following the tables are case study reports on each subject. These reports provide a detailed description of each child's motor ability throughout the program. By following Kephart's (49) "Observations of Basic Motor Movements", the investigator was able to objectively observe and note the characteristics of each subject's motor performance. A brief mention has also been made of the causative factors of each child's problems. Medical diagnosis as well as psychological and teacher reports provided this information.

Results of Frostig and Carpenter Tests

The Perceptual Quotient (P.Q.) and Motor Quotient (M.Q.) scores listed in the following tables can be interpreted in
the same manner as Intelligence Quotient (I.Q.) scores. For each age group, the P.Q. and M.Q. have a median of 100, a lower quartile of 90, and other percentile points consistent with the I.Q. values of intelligence tests.

A discussion of the P.Q. and M.Q. scores follows the case study reports. An explanation of the purpose and interpretation of Frostig Age Equivalents is also provided.

TABLE I

RESULTS OF FROSTIG TEST
DIFFERENCES BETWEEN INITIAL AND FINAL PERCEPTUAL QUOTIENT SCORES

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>INITIAL P.Q. SCORE</th>
<th>FINAL P.Q. SCORE</th>
<th>DIFF.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Douglas B.</td>
<td>66</td>
<td>70</td>
<td>+ 4</td>
</tr>
<tr>
<td>Kenneth C.</td>
<td>80</td>
<td>88</td>
<td>+ 8</td>
</tr>
<tr>
<td>Lynne F.</td>
<td>70</td>
<td>75</td>
<td>+ 5</td>
</tr>
<tr>
<td>Neil H.</td>
<td>89</td>
<td>94</td>
<td>+ 5</td>
</tr>
<tr>
<td>James J.</td>
<td>90</td>
<td>100</td>
<td>+10</td>
</tr>
<tr>
<td>Stuart M.</td>
<td>66</td>
<td>94</td>
<td>+28</td>
</tr>
<tr>
<td>Deborah W.</td>
<td>75</td>
<td>80</td>
<td>+ 5</td>
</tr>
<tr>
<td>Randy Y.</td>
<td>80</td>
<td>92</td>
<td>+12</td>
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<tr>
<td>Group Mean</td>
<td>70.00</td>
<td>86.62</td>
<td>+ 9.62</td>
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</tbody>
</table>
TABLE 2

RESULTS OF CARPENTER TEST

DIFFERENCES BETWEEN INITIAL AND FINAL MOTOR QUOTIENT SCORES

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>INITIAL M.Q. SCORE</th>
<th>FINAL M.Q. SCORE</th>
<th>DIFF.</th>
</tr>
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<tr>
<td>Douglas B.</td>
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</tr>
<tr>
<td>Kenneth C.</td>
<td>89.59</td>
<td>97.00</td>
<td>+ 7.41</td>
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<tr>
<td>Lynne F.</td>
<td>93.04</td>
<td>106.21</td>
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<td>Neil H.</td>
<td>82.39</td>
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<td>James J.</td>
<td>96.00</td>
<td>106.32</td>
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<tr>
<td>Stuart M.</td>
<td>101.80</td>
<td>104.24</td>
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<tr>
<td>Deborah W.</td>
<td>90.13</td>
<td>99.54</td>
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<td>Randy Y.</td>
<td>80.71</td>
<td>83.51</td>
<td>+ 2.80</td>
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<tr>
<td>Group Mean</td>
<td>90.09</td>
<td>97.98</td>
<td>+ 7.89</td>
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</table>
### TABLE 3

INITIAL AND FINAL FROSTIG SUBTEST AGE EQUIVALENTS (YEAR-MONTH)

**Key to Abbreviations:**
- E.M.: Eye-Motor Coordination
- F.G.: Figure-Ground
- F.C.: Form Constancy
- P.S.: Position in Space
- S.R.: Spatial Relations

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>CHRON. AGE</th>
<th>E.M.</th>
<th>F.G.</th>
<th>F.C.</th>
<th>P.S.</th>
<th>S.R.</th>
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<tr>
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<td>7-0</td>
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<td>7-6</td>
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<td>Lynne F.</td>
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<td>5-0</td>
<td>7-0</td>
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<td>Neil H.</td>
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<td>8-3</td>
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<td>7-0</td>
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<tr>
<td>James J.</td>
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<td>9-0</td>
<td>7-0</td>
<td>8-3</td>
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<tr>
<td>Stuart M.</td>
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<td>8-3</td>
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<tr>
<td>Deborah W.</td>
<td>6-7</td>
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<td>4-6</td>
<td>6-3</td>
<td>5-0</td>
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<td>7-0</td>
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<td>5-9</td>
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<td>6-0</td>
</tr>
<tr>
<td>Randy Y.</td>
<td>8-7</td>
<td>9-6</td>
<td>6-6</td>
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<td>5-6</td>
<td>7-6</td>
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<td>7-0</td>
<td>8-3</td>
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</table>
CASE STUDY REPORTS

SUBJECT: Douglas B.  AGE: 9 years, 6 months
HEIGHT: 50½"  WEIGHT: 58 lbs.  I.Q.: 118

Although above average in intelligence, Doug was referred to the program because of poor visual-motor skills and emotional problems. Doug's school record indicated that he had an extremely short span of concentration and often occupied himself in a "dream world". An investigation of his family showed that he received no encouragement or stimulation to attempt any form of physical activity or game. Doug's mother was noticeably overprotective and yet demanding.

At the beginning of the program it was observed that Doug was very inconsistent in his motor performance. Some days he was able to perform stunts which were impossible other days. This appeared to be related to emotional factors. On days when Doug did not apply himself he was very depressed and spent most of the time sulking or crying.

When the program began Doug had a very limited awareness of the parts of his body and the movements that were possible from each part. When asked to move a part of his body in a specific manner, Doug usually moved in a manner other than that which was required. As an example, when Doug was lying on his back with his arms stretched out to the sides, he was asked to try and touch his arm with his leg, keeping
the heel on the ground. Doug was unable to follow this direction and would move both legs, his arm, and sometimes arms and legs together.

Doug had great difficulty performing movements which required concentration and control. He was unable to walk heel-to-toe along a balance beam and could not crawl under low objects. When balancing Doug would become excited and look around, thus losing his balance. Although Doug could stand on one foot for several seconds with his eyes open he would lose his balance as soon as he closed his eyes.

When given a task, Doug could only perform it one way. He was unable to modify or improvise his movements. When asked to move along a bench in a different way than usual, Doug had difficulty imagining other ways of performing this task.

Unless Doug was able to perform an activity well he refused to apply himself. If he failed on his first attempt he would say he could not do it or did not enjoy the activity. Also, Doug often became annoyed when the investigator asked him to perform an activity in a specific way. At a glance Doug appeared to be doing what was asked, but if one observed carefully one usually noticed that he was not performing as he was instructed.

Throughout the program Doug was encouraged to perform the motor tasks in a more careful and slower manner. Doug's emotional problem was taken into consideration and he was
praised for all his efforts. Towards the end of the program he was performing stunts more efficiently largely because he was concentrating and trying harder. The investigator found that as long as Doug was rewarded for his efforts he would continue to apply himself. An improvement was observed in Doug's motor skills, especially those involving balance and agility. This improvement was reflected in a 7.01 increase in his Motor Quotient (M.Q.).

Doug's initial Frostig scores were below his age level in all five areas. Although nine years of age, his perceptual abilities were below those of an average seven year old. Doug's final Perceptual Quotient score (P.Q.) showed an increase of four points, however all areas were still below average. Mrs. E. Sharpe, who administered the final Frostig test, suggested that emotional factors played a significant part in Doug's poor perceptual test performance. She indicated that his fear and frustration of doing something incorrectly hindered his achievement. This factor also appeared to interfere with his reading ability. His teacher noticed that Doug became very anxious when asked to read aloud. When the program ended Doug's reading ability had shown some improvement and he no longer displayed the same amount of nervousness when asked to speak aloud.
This was Ken's first year in a Vancouver school. He was repeating grade two because his academic achievement was not up to standard. Ken appeared to have difficulty in following class discussions and required a longer time than the other children to complete an assignment. His teacher indicated that part of Ken's problem was his poor attention. He was very easily distracted and often, when asked a question, was apparently not even aware of the topic being discussed. Although Ken needed frequent direction he was a pleasant and responsive boy.

At the beginning of the training period, Ken would attempt every motor task in a rapid and careless manner, showing little concern about the quality of his performance. When asked to walk slowly, heel-to-toe along the walking board, he would run and often lose his balance. If the investigator stood beside him and emphasized that the task must be performed in a careful manner Ken would display many faulty movements, such as poor foot placement and swaying from side to side. It appeared that Ken attempted to avoid making faults in the various tasks by rushing through them as quickly as possible.

When observed performing tasks indicating limb differentiation, Ken displayed a preference for the right side of his body. His right arm movements were much more
controlled than his left. When lying on his back, Ken could not cross the "midline" of his body using his left arm, without moving his head or trunk.

Ken's ability to stand on one foot was also observed to be much superior on his right side. When asked to change his body direction Ken had to hesitate and sometimes stop before moving to the left side. He also became confused and hesitant if he was asked to perform a movement leading with his left foot.

Because Ken was encouraged to slow down, his skill in many activities increased. This was most obvious when he was asked to crawl across the floor on his stomach using only his limbs to propel his body. When the program began he could not keep his stomach on the floor because it slowed him down. However, as Ken was encouraged to slow down and concentrate on his movement, he became able to crawl in the proper manner.

Ken improved 7 points in his M.Q. which was near average at the end of the program. His greatest improvement was observed in stunts requiring agility. His Sargent Jump increased by five inches and his Iowa-Brace score was 4.36 points higher when the program ended.

Ken's initial Frostig test scores indicated below average visual-motor development. Deficiencies were noted in Eye-Motor Coordination, Form Constancy, and Spatial Relations. At the conclusion of the program, Ken's P.Q.
increased 8 points to 97, almost average, and improvements were noted in the three areas which were previously below average. The area of visual perception in which Ken improved most was Eye-Motor Coordination. His perceptual age equivalent had increased from five years, three months to ten years.

Both the classroom teacher and the investigator observed an improvement in Ken's behavior. Although he still was easily distracted, Ken appeared to be capable of greater concentration in the classroom. His teacher mentioned that his participation in discussion and reading ability have shown recent signs of improvement. The investigator also noted that Ken's attitude towards physical activity had improved as he appeared to have more pride and concern in his motor performance.
Lynne was a small, thin, shy girl who was in a special ungraded class for slow learners. Although she tried hard in school, she had great difficulty in grasping anything new and needed individual assistance. Her school record indicated that besides having below average intelligence she also had serious mixed dominance problems. It was noted that Lynne used her left hand and left foot for most activities, yet appeared to favour the use of her right eye. Lynne's reading difficulties were attributed to a lack of established laterality. Her teacher mentioned that Lynne made a number of reversals, often being unable to distinguish "b"'s from "d"'s or "p"'s from "q"'s.

When the program began Lynne was unable to differentiate parts of her body. When lying on her back she could not innervate and move a shoulder or hip without involving other parts of the body. When she moved one arm at the shoulder, the other shoulder, the head, and the leg became involved in the movement.

At the beginning of the program Lynne also showed an obvious deficiency in balance and coordination. She was unable to sit erect with her legs extended. Her usual sitting position was to fold her legs back at the knees and sit between her legs for balance. Lynne's performance of balancing stunts such as standing or hopping on one foot
was very poor on her right side. Because Lynne had no awareness of the right and left sides of her body she displayed an obvious directionality problem.

Faulty movement patterns were also observed when Lynne performed stunts using a ball. Lynne's arm movements when throwing a ball were extremely rigid, jerky, and uncontrolled. When bouncing a ball, she held her elbow to her side and used a jerky arm movement to release the ball.

Throughout the program an attempt was made to provide Lynne with experiences from which the two sides of the body could be compared. As a result of practicing tasks which required the use of one side, both sides or alternating sides of her body, Lynne became aware of the differences between these experiences. When the program ended, a great improvement was noted in Lynne's awareness of the right and left sides of her body. Her improvement in laterality was observed in balancing tasks, as she could now determine which side of her body had to move, and how it had to move in order to maintain balance.

As a result of frequent instruction and practice in identification of body parts and imitation of movements, Lynne showed a significant improvement in her awareness and control of body parts when the program ended. During the initial Carpenter test Lynne found it extremely difficult to understand and execute the movements required for the Squat-Thrust test. She was only able to complete two and
one-half squat-thrusts in the allotted time. When the program ended, Lynne performed the task much more efficiently and was able to complete five and one-half squat-thrusts.

Lynne's parents have indicated that they have observed an improvement in Lynne's performance of physical activities. She recently learned to ride a bicycle, a task she was unable to perform previously.

When tested by a psychologist before the commencement of the training period, Lynne showed ill-defined spatial concepts and had considerable difficulty with Block tests, where the relationships of various parts had to be organized in an "abstract spatial" sequence. The psychologist believed that Lynne's mixed dominance problems were a major contributor to her perceptual difficulties. When administering the Frostig test the psychologist noticed that Lynne's pencil control was fair but her eye-hand coordination tended to be slow on coding items.

Lynne's initial Frostig test showed an obvious deficiency in her ability to identify certain geometric figures when they were presented with other similar figures. She also experienced difficulty with Spatial Relations and Figure-Ground. At the end of the program, Lynne's P.Q. had increased five points to 75, still well below average. Although improvements were observed in her deficient areas, Lynne still required further remedial attention. Her final Form Constancy score was at the five years age equivalent, almost three years behind her chronological age.
SUBJECT: Neil H.  
AGE: 9 years  
HEIGHT: 51"  
WEIGHT: 58 lbs.

Neil was a quiet, shy boy who was extremely cooperative and attentive. He was referred to the program on the recommendation of his family physician and Dr. Ellis of the Vancouver School Board. He was diagnosed as a very poorly coordinated boy who had a serious visual disability. Prior to the program, Neil had a corrective operation on his left eye and was required to wear a patch during the summer. Because he was learning to see objects in a new way, Neil moved very cautiously at the beginning of the program. Neil also exhibited mixed dominance problems. His school report indicated that he was left-handed, right-eyed, and right-footed.

At the start of the training period, Neil always remained alone and very seldom interacted with the other subjects. Neil often was unable to understand the investigator's directions and would usually wait until the other children had begun a task so he could see what was expected of him. When Neil was addressed he would bend his head to the left and close his left eye. He wore glasses throughout the program as a corrective measure for his vision problem.

Several interesting observations were made from Neil's performance of the "Basic Motor Movements". When asked to pull himself up to a sitting position, Neil showed poor head
control. His head appeared "tied into" his shoulders and all were lifted as a unit. In order to lift his head while lying on his back Neil had to tense his whole body. Problems were also observed when Neil was required to change his body position. When asked to move from a sitting to standing, or standing to lying position, Neil had to stop and think of the movement required to attain the requested position.

Neil also displayed difficulties on stunts demanding balance or controlled movement. When he attempted tasks requiring balance it was necessary for the investigator to hold Neil's hand. Neil would hesitate and tremble before making any movement; often he appeared to "freeze up" and became unable to take the first step. After a month of practice, however, Neil exhibited a remarkable improvement in his balancing ability. This was largely due to an increasing confidence in himself. By the end of the program Neil was performing many activities which he would not dare attempt earlier. This was most evident in tasks involving elevation, such as walking along an inclined bench without any assistance.

Another obvious improvement in Neil's motor performance was observed on the trampoline. When the program began the investigator had to hold Neil's hands to have him stand on the trampoline. At the end of the training period Neil would take his glasses off, roll onto the trampoline, and perform knee, seat and front drops without any hesitation.
Neil's M.Q. increased from 82.39 to 93.00 with improvements noted in all areas of the Carpenter Test. His Iowa-Brace score showed that Neil could perform four stunts at the end of the program as compared to two at the beginning. An improvement of six inches was also observed in his Sargent Jump.

Neil's P.Q. increased from 89 to 94 during the program with improvements noted in Figure-Ground and Spatial Relations, the two areas of perception in which he required remedial attention. When administering the final Frostig Test, Mrs. Sharpe indicated that Neil's vision problem was the major factor in his distortion of images.

An improvement was also observed in Neil's social development, both by his classroom teacher and the investigator. The investigator was pleased to note that as Neil became more skilled and confident in himself he began to interact with the other children. This was most obvious in his enthusiastic participation in relay activities, where he displayed great excitement and concern about his team's performance. His classroom teacher indicated that although Neil was still quiet and timid he no longer was as reluctant to make an attempt at a new experience and contributed much more to group discussions.
SUBJECT: James J.  AGE: 9 years, 1 month  
HEIGHT: 51"  WEIGHT: 75 lbs.  I.Q.: 90

Although having average intelligence, Jamie's school performance was poor and he was placed in a special class for slow learners. His teacher described him as very immature, inattentive, and restless in class. Because he sought attention, Jamie would continually disrupt the class by whistling or throwing objects.

Jamie's school report indicated that he had poor coordination and showed some direction confusion. When examined by a psychiatrist, it was suggested that part of Jamie's troubles were due to family problems. His mother appeared to be unable to cope with the daily demands placed upon her. It was also suggested that Jamie be enrolled in a supervised play situation such as a day camp, during the summer. A special remedial program was recommended in which Jamie could receive perceptual-motor training.

At the beginning of the program Jamie performed activities in a careless and clumsy manner. When running or skipping he often ran into the wall or another child. His frequent accidents seemed to be caused by a combination of not following directions and poor coordination. When running, Jamie showed difficulty in starting and stopping. He was also observed to have great difficulty crawling in a controlled manner. He was unable to coordinate the movement of his legs and arms to propel him along the floor.
Instead of a single movement pattern there was a series of uncoordinated movements.

Jamie also displayed poor body control on the trampoline when the program began. He was unable to change his body direction in the air after completing a bounce. When in the air, Jamie appeared to have no control over the movements of his arms and legs. As an example, when doing a seat-drop, Jamie showed difficulty in moving his legs out in front of him.

Jamie's motor skills had improved greatly by the end of the program, largely because he became more attentive and involved. His performance of tasks requiring coordination improved significantly as was readily observed in his trampoline performance. When the program ended, Jamie became quite proficient on the trampoline and could perform all the stunts shown to the group. Jamie was able to perform five stunts of the Iowa-Brace Test at the end of the program as compared to two at the beginning. This improvement in motor ability was reflected in his M.Q. increase from 96.00 to 106.32 (above average).

Jamie's P.Q. also reached the average at the end of the program. An improvement was noted in four of the five areas of visual perception. His Eye-Motor Coordination and Position in Space age equivalents improved by two years, six months, and one year, nine months respectively. Jamie was the only subject to attain average scores in all five
areas of the Frostig Test.

Toward the end of the program an improvement was also observed in Jamie's attitude. Although he remained excitable and restless, Jamie no longer disrupted the group as often as he did earlier. He also required less individual attention as he became more attentive. Jamie's initial apathy towards the program disappeared to the extent where he was usually the first subject to arrive and the last one to leave. A similar improvement was observed by the classroom teacher. When the program ended, Jamie appeared more interested and became more involved in class activities.
SUBJECT: Stuart M. AGE: 9 years, 6 months
HEIGHT: 52" WEIGHT: 68 lbs. I.Q.: 75

Stuart was a very outspoken and aggressive boy. He was placed in a special ungraded class because of his below average school achievement and poor behavior. Stuart had to repeat grade one because of three bouts of abdominal surgery. The psychologist's report indicated that Stuart's family background was a major factor in his perceptual-motor problems. His parents were separated and he was placed in the custody of his mother. The psychologist reported an inconsistency in the mother's treatment of Stuart which created a hostile and confusing atmosphere in the home.

In school, Stuart showed a disinterested attitude and continually disrupted the class. His teacher reported that Stuart constantly annoyed the other children by throwing objects at them or hitting them. His school principal indicated that Stuart was performing much less than expected even when his recorded assessment of ability was taken into consideration. On the Wechsler Intelligence Scale for Children, Stuart had trouble arranging a series of pictures in logical order, showing left-right reversal or starting in the middle. His eye-motor coordination was also noted as being very poor.

Throughout the program Stuart dominated most group games and activities. His aggressiveness and superiority at most gross motor activities involving strength, enabled
him to become the group leader. More timid members such as Neil and Lynne were afraid of Stuart as he often would push or trip them. Although not popular with the other children, Stuart seemed to impress some of the other boys with his mischievous behavior and "smart-aleck" comments. On several pieces of apparatus such as the gym set and trampoline, Stuart was able to perform stunts which no other children were able to do. It was noticed that if a task was presented in which Stuart was unable to excel, he would substitute another activity; one in which he could receive recognition. This often was a reckless "daredevil" stunt which resulted in an accident.

The observations of Stuart's performance of the "Basic Motor Movements" provided very interesting and valuable information to the investigator. It was noticed that when Stuart was asked to perform a specific and controlled movement, especially a fine motor activity, he often had great difficulty initiating the movement. If a modification or change in his spatial surroundings occurred, Stuart often was unable to make a movement he had performed earlier. This was illuminated in a task demanding that Stuart jump over a beanbag, tied to the end of a rope, as it was rotated in a circle by the investigator. As long as the beanbag came from the same direction, Stuart had no trouble in jumping over it. However, when it came from the opposite direction, Stuart was unable to perform the necessary jumping
movement. This same observation was made when Stuart and the other subjects formed a circle around the investigator and were told to catch a ball when it was thrown to them. Stuart would catch it if it came from the same direction and in the same order. However, if the sequence was broken, he had great difficulty adjusting to the new situation and would frequently miss the ball.

When performing the movements designed to indicate limb differentiation, Stuart often was unable to move his left arm or leg as he had just moved his right arm or leg. He usually had to pause and think of what movement was required to move his opposite limb and often he would make many faulty movements before performing the correct one. This problem was demonstrated when Stuart was asked to make circles which slowly increased in circumference, with alternating arms. As a point of interest, Stuart was unable to pat the top of his head with one hand while making a circling motion on his stomach with the opposite hand, until the ninth week of the program.

At the end of the program an improvement was observed in Stuart's performance of activities requiring eye-hand coordination. This was most obvious in his increased ability to bounce, throw, and catch a ball. When the program began Stuart was unable to bounce a ball and catch it five consecutive times. At the end of the training period Stuart could walk forwards or backwards along the
balance beam while bouncing and catching a ball.

A significant improvement was also noted in Stuart's ability to perform movements with alternating sides of his body. He appeared to develop some understanding and anticipation of what movements were required to perform the same activity from different positions or situations. When the program ended it was almost impossible for Stuart to error in the "jump-over-the-beanbag" activity. Stuart's M.Q., which was above average at the beginning of the program, increased by 2.44 points.

Stuart's initial Frostig Test showed all scores well below average. His ability to see the relation of one object to another in space was practically nil, as was his ability to discriminate the positioning of objects one from another. Stuart's initial Position in Space score was at the five year, six month age equivalent and his Spatial Relations score was at the four year age equivalent. His final scores in Position in Space and Spatial Relations had reached the respective age equivalents of eight years, nine months and eight years, three months. At the end of the program, Stuart's P.Q. had increased 28 points, from 66 to 94—the largest gain of all the subjects.

Although some improvement was observed in Stuart's behavior in the classroom and in the training periods, he still had emotional problems which required further attention. It appeared that Stuart's problems originated in the home.
as he would arrive at school some days in a very aggressive and bitter mood. The investigator believed that had the program continued longer more improvement would have occurred in Stuart's behavior.
Debbie, the youngest subject in the study, was referred to the program because of her clumsiness and hyperactivity. Because she was unable to function normally in school, Debbie was interviewed by a psychiatrist who diagnosed her problem as "minimal cerebral dysfunction with particular difficulties in spatial orientation, especially in translating visual stimuli into appropriate motor patterns such as those required in copying and printing".

Debbie's home life seemed to be a contributing factor to her problems, as her mother had admitted having difficulty with her children and her father was very authoritarian, lacking understanding of Debbie's problems. In addition, both parents treated Debbie in an inconsistent manner.

In the classroom Debbie isolated herself from the other children and showed little desire to participate in class activities. Her school record indicated that she required firm direction, frequent encouragement and re-direction. Debbie's classroom teacher described her as "transient, with an extremely short attention span". Although seldom contributing to class discussions she was a talkative girl who appeared to "chatter impulsively". Patience was required in handling Debbie as she was quite spontaneous and seemed inclined to take liberties and be manipulative. This was most evident in her "saying aloud" whatever came
into her mind. Without showing any concern about the subject being discussed by the teacher, Debbie would ask an irrelevant question and expect an answer.

When the program began Debbie appeared very restless and exhibited awkward body movements. Faults were observed in almost all "basic motor movements". Debbie showed very poor head control as was indicated by her movement when pulling herself up from a back lying position to a sitting position. Her shoulders would tense and lift first with her head lagging behind in a rigid position. In order for Debbie to move any single part of her body it was necessary for the remainder of her body to become tense. When observing limb differentiation it was noticed that Debbie could move her hands into tasks only if the upper arms were kept close to the body and all movement originated from her elbows.

Obvious difficulties were also observed in Debbie's motor coordination and vision. Although she wore corrective glasses, Debbie bent her head to one side and squinted when she attempted to observe an object in motion. Inadequate visual-motor coordination was indicated by Debbie's inability to follow a moving target with her eyes and hand. Her pointed finger and eyes never seemed to be in exactly the same place at the same time.

Debbie's poor coordination was most obvious in tasks of locomotion. When crawling or running, there was no evidence
of a motor pattern. Instead, there were a series of awkward, uncoordinated movements. Debbie seemed to be unable to relax as her arms and legs became rigid as soon as she began a movement.

Debbie showed a slow but steady improvement in motor skills during the training program. Her coordination of body parts, especially eye-hand coordination, improved greatly. When the program began, Debbie was unable to catch a ball which was gently thrown to her. She also was unable to bounce and catch a ball by herself. Debbie's improvement in this skill was one of the most significant changes observed in the program. Although her wrist and fingers were still too rigid and her arm movement jerky, Debbie was able to perform many tasks with a ball when the program ended. She could now catch a thrown ball while bouncing on the trampoline. Also, she no longer complained that her eyes hurt her after practicing ball skills. Debbie's M.Q. increased 9.41 points, from 90.13 to 99.54.

Debbie's initial Frostig score showed a P.Q. of 75, with deficiencies in four areas. Her Figure-Ground and Form Constancy scores were at the four year, nine month and four year, six month age equivalents. The final Frostig score showed a P.Q. increase of five points, with improvements noted in three of the four problem areas. However, further remediation was still required in her Eye-Motor, Figure-Ground, and Form Constancy skills.
An improvement was also observed in Debbie's behavior by her parents, her teacher, and the investigator. At a special meeting, held to evaluate her progress, (attended by her remedial teacher, school nurse, a psychologist and a psychiatrist) it was determined that Debbie could remain in her present school as a definite improvement had occurred in her behavior and perceptual-motor development. It was reported that Debbie no longer separated from the other children as readily as she did earlier. Her parents and teacher indicated that she did not cry as much as she did earlier and that she appeared to have more confidence in herself. Debbie also was no longer in need of the same amount of medical attention and drug medication.
Randy was a member of a special ungraded class for slow learners. His teacher described him as a boy who required individual attention as he had difficulty in understanding the material presented in the classroom. Randy's school record indicated that he was unable to understand the relationship of things he saw. Because of his inability to follow or participate in class discussions Randy often occupied himself doing things other than those he was asked to do.

Obvious motor problems were also evident in Randy. One factor contributing to his difficulties was his obesity. Randy was extremely overweight and every movement required a great effort. Initial observations of Randy's motor performance showed him to be very awkward and slow in his movement. When asked to move from a sitting to a standing position he had to place his hands on the floor and push, in order to lift himself. In movements requiring changes in body position, Randy was much slower than the other subjects. When lying on his back, he had great difficulty in lifting himself to a standing position; he had to roll over on his stomach, push up with his arms, and support his weight on his hands and knees.

Faulty movements were also observed when Randy attempted locomotor activities. When running, he took short steps
pointing his feet outwards. His head was projected forward and his eyes were looking downwards rather than in front of him. When walking or running Randy shuffled his feet rather than lifting them. Because of his obesity, he tired very quickly during locomotor activities and often he was forced to rest while the others continued a strenuous task.

Randy also displayed difficulties in his performance of activities requiring balance. When asked to stand still on a spot for thirty seconds he would rock backwards and forwards and sometimes lose his balance, causing him to move his feet. Randy was also unable to hop on one foot along a line without losing his balance. Because of his size Randy was often laughed at and ridiculed by the other children when he fell while attempting a balancing activity. Thus, he was rather self-conscious and tried to avoid activities in which he would be embarrassed.

Randy's poor attitude toward physical activity at the beginning of the program improved as he became more involved. As the training sessions progressed, Randy became quite proficient on the trampoline and by the end of the program he could perform most of the stunts shown to the group. Randy was very proud of his efforts on the trampoline and seemed to develop more confidence in himself after achieving this success. Randy's increased confidence was reflected in an improvement in his attitude when attempting a task in which he had great difficulty. Although he still could
not walk along a balance board without falling, Randy would make a determined attempt at the task.

As a result of daily reminding, Randy's posture showed signs of improvement at the end of the program. When moving he now would hold his head up and his shoulders back. In spite of improvements in certain skills such as those required on the trampoline and in hopping, Randy's movement was still adversely affected by his obesity. An increase from 80.71 to 83.51 was noted in Randy's M.Q. His final M.Q. suggests that more instruction and practice is necessary.

Randy's initial Frostig Test identified his main perceptual problem as an inability to identify the position of an object in space. The psychologist who administered the test indicated that Randy's ability in this area was comparable to that of the average child aged five and one-half years. Some difficulty was also observed in his Figure-Ground, Form Constancy, and Spatial Relations.

Randy's final Frostig Test showed an increase of twelve points and an improvement in the four areas in which he needed remedial attention. His scores in Figure-Ground and Form Constancy improved significantly from well below average to average. Although an improvement was noted in his Position in Space score, further remediation was required in this area.

Improvements were also observed in Randy's behavior and school performance. When the program ended his classroom teacher indicated that although Randy still required individual
attention, he appeared to have a better understanding of class discussions. She attributed this improvement to an increase in Randy's interest and involvement in group activities. The investigator supports this suggestion and maintains that a significant part of Randy's improvement in motor performance was due to his increased ability to follow directions and apply himself to a task.
Discussion

The case study findings indicate that children having perceptual-motor problems often exhibit similar faults in their performance of physical tasks. Poor differentiation, balance and coordination were readily observed in the subjects, some displaying greater weakness than others. Usually accompanying the physical handicap of the child was an emotional problem of some sort. In the case study subjects this problem manifested itself as fear, a negative attitude, or aggressive hyperactive behavior.

The initial and final Perceptual Quotient (P.Q.) and Motor Quotient (M.Q.) scores provided important information to the investigator. M.Q. and P.Q. scores, like an I.Q. score, serve to indicate the ability of an individual child as compared to the average child. The M.Q. and P.Q. are not to be regarded as measures of fixed ability. Rather, a low M.Q. or P.Q. indicates that remedial attention is required. Scores below ninety on either the M.Q. or P.Q. suggests that the individual has an equivalent percentile rank of twenty-five or less (33:478).

The results of this study show that at the beginning of the program only one subject (Stuart) had a M.Q. of over 100. The others ranged from 81 to 96. After fourteen weeks of special training, four children had a M.Q. of 100 or more. Improvements in M.Q. ranged from 2.44 points to 13.17 points. As mentioned in the case studies, significant
improvements were observed in the motor capacity of each subject. The investigator considered the improvements in motor performance to be quite satisfactory. Although further improvements are required for most of the children, the investigator believes that all of the subjects would now be able to function in a normal school gymnasium situation.

An improvement was also observed in the visual perception of the subjects. Increases in the P.Q. ranged from four points to twenty-eight points. Because the five areas of visual perception are relatively independent it is necessary to examine each area separately when discussing the results. As mentioned by several investigators (17) (33), Figure-Ground appears to be the area of greatest concern when trying to rehabilitate the slow learner. The results of this study indicate that six of the eight children required remedial attention in Figure-Ground. A raw scale score of eight or below in any area of the Frostig Test indicates the need for special training (33:478). When the program ended, an improvement was noted in the Figure-Ground score of all the subjects. Five of the children had scaled scores of nine or ten, indicating that their Figure-Ground ability was now near average. Similar improvements were noted in the remaining four areas of visual perception.

Because a subtest scale score is rather limited in its interpretation the investigator believed it would be of value to include the perceptual age equivalent of each subject's
scaled scores. It seemed more informing to tell a teacher that "Eight-year-old Johnny cannot differentiate position in space as well as a six year old boy is expected to do", than to say a subtest scale score of eight indicates the need for special training. The experimenter and Mrs. E. Sharpe, who administered the final Frostig Test, were pleased and in some cases amazed at the observed increases in perceptual age equivalents. Stuart's Frostig scores showed subtest age equivalent increases of three years, three months and four years, three months. Although having an I.Q. of 75, the lowest of all the subjects, Stuart displayed the greatest improvement in visual perception. This finding suggests that further research be conducted in an attempt to determine whether a relationship exists between intelligence and improvement in perceptual abilities of children participating in a motor training program.

In addition to improved perceptual and motor abilities it was also observed that positive changes occurred in the child's attitudes and behavior. Although subjective, the comments of the parents and teachers indicated that the children appeared to be behaving in a more mature and controlled manner. It is strongly believed by the investigator that a program of longer duration would encourage more significant results in terms of behavioral changes. It is also believed that the academic performance of the slow learner could be greatly enhanced by a special perceptual-
motor training period which was provided for the entire school year.

The results of this study support the findings of previous investigators who conducted similar perceptual-motor programs. Although the case study technique does not permit generalization, the investigator believes that the descriptive results of this type of study provide a more detailed and informative account of the perceptually-motor handicapped child. The subjects observed in this study were similar in perceptual and motor ability to the slow learners described by Frostig (32) and Kephart (48). Frostig (33:464) indicated that many children placed in special classes for slow learners are handicapped by poor eye-motor coordination and by disturbances in figure-ground perception. The results of the initial Frostig Test scores in this study indicated that all of the subjects required remedial attention in one or both of these areas.

The improvements in visual perception noted in the present study are similar to those attained by Berkov and Waxman (33:496). In their study, a control group and an experimental group were selected from a group of kindergarten children who were given the Frostig Test. Initial Frostig scores for the twenty training children ranged from 62 to 124, with eight children scoring below 90; the range for the twenty-two control children was 50 to 128, with six children scoring below 90 and two receiving a score of 90.
An experienced teacher met the training group for a total of eighteen sessions of eighty-five minutes each, in which the motor activities designed by Frostig and Horne (32) were provided (activities involving differentiation, body awareness, coordination). The children in the control group remained with their regular teacher and followed the prescribed school curriculum. Upon retesting, both groups gained on the Frostig Test, but the trained group gained significantly more. Using the median gain of fifteen points as the cut-off, a two-by-two table produced a chi-square value of $9.9 (p = .005)$. It was noted that all the children in the trained group received a retest score of 90 or above (one girl received 90); four children in the control group fell below 90.

In the present study, the subject's performance and ability to learn new motor patterns improved significantly as a result of the child's motor experiences which increased his ability to identify, differentiate, and coordinate his body movements. When the training period had ended the main objective of the perceptual-motor program had been fulfilled. This objective, stated by Kephart (49) and supported by the investigator, was to provide motor learning experiences which permitted the use of movement, not only for specific purposes, but for the more generalized purpose of information gathering. Through these motor explorations, each subject achieved an improved knowledge of himself and
the world around him.

The results obtained in the present study are in accord with those of similar studies in which Kephart's views have been adapted as the basis for the remedial program. Duggan's (24) study also conducted at the McBride School, with the assistance of Mrs. E. Sharpe, indicated that special motor training, similar to that employed in this study, was the most significant factor in the improvement of General Motor Ability and Visual Perception among a group of grade two children.

Fretz, Johnson, and Johnson (30) recently conducted a similar motor training program which supports the findings of the present study. Standardized tests of perceptual-motor development (Frostig Test and Johnson Motor Achievement Battery) were administered to fifty-three children enrolled in an eight week remedial program and thirty-one applicants who were waiting to enroll when space was available. A comparison of pre- and post-program test performance of the participating children, compared to the controls indicated that the participants made significant improvements in all perceptual-motor measures and in performance I.Q.

Although the results obtained in the present study are definitely favourable, certain limitations deter one from making generalizations. Because there was no control of external factors such as home environment, other special training, etc. it is not possible to consider the program
soley responsible for the observed improvements in the children. Also, no attempt was made to control other possible influencing factors such as having two instructors with different personalities and the effect of receiving individual attention and motivation. However, the investigator, after having observed the children throughout the program, would not hesitate to suggest that the special motor training given to the subjects was the major factor contributing to their improved perceptual and motor ability. Admitting the limitation of being without a control group, the investigator believes that the information provided in the case study reports indicates the value of the program. The results, described as objectively as possible, reveal that the slow learner can be aided by special perceptual-motor training.
CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to provide a description of the physical performance of a group of slow learning children who participated in a perceptual-motor program and to observe the effects of special training in motor skills on the visual perception and motor capacity of each child. A case study approach was adapted in order to provide as much information as possible on each subject.

Eight subjects ranging from six years to nine years of age, were selected to participate in the study. The subjects, all having learning difficulties, were referred to the program because of a diagnosis of retarded perceptual-motor development.

The pre-training and post-training tests were standardized for all the subjects. Each child was given the Frostig Developmental Test of Visual Perception and the Carpenter General Motor Capacity Test at the beginning of the program. The subjects then received approximately fifty minutes of daily instruction in motor skills for a total of sixty-five
days. All the special training in motor skills took place in the Perceptual-Motor room at Sir Richard McBride School in Vancouver, British Columbia.

At the conclusion of the special training period, the subjects were again tested in visual perception and general motor capacity. The scores on the initial and final tests in motor capacity and perceptual abilities were compared and the differences were recorded.

Information for the case study description of each subject was based largely on Kephart's "Observations of Basic Motor Movements". The observations permitted an initial assessment of each child and also provided an indication of improvements in motor performance throughout the program.

Conclusions

The case study findings of this report indicate that children, having deficient perceptual-motor development, often exhibit similar faults in their performance of physical tasks. Difficulties in differentiation, balance and coordination were readily observed in the subjects as was some form of behavioral problem.

The results of the study indicate that children having regarded perceptual-motor development, are able to improve significantly in both their motor and perceptual ability by participating in a special motor training program. The finding is, however, subject to limited interpretation,
since other factors may have contributed to the observed improvements.

Possible limitations in the study were:
1. Hawthorne effect,
2. Possible effect of extraneous influences, such as home environment, private tutoring, and the like,
3. Absence of a control group, and
4. Effect of having two instructors with different personalities.

In spite of these possible limitations, a significant improvement occurred in the motor and perceptual ability of the subjects. The results showed that the Motor Quotient and Perceptual Quotient improved in all the children and in some cases were average when the program ended. Teacher's and parents' remarks indicated that the children also showed marked improvement in their behavior attitude. These findings support the investigator in his firm belief that a special motor training program is a major contributor to the overall rehabilitation of the perceptually-motor handicapped child.
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BIBLIOGRAPHY


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APPENDIX A

MOTOR TASKS AND EQUIPMENT USED TO DETECT AND RECTIFY PERCEPTUAL-MOTOR PROBLEMS

This section presents a brief mention of the motor tasks and equipment which permitted an assessment of the child's perceptual-motor behavior and also formed the basis for the training program. The tasks have been designed for and clinically investigated with children six to nine years of age. Further information concerning the selection of motor tasks for this age range and older can be obtained by referring to Kephart (48).

WALKING BOARD (OR BEAM)

The walking board is a modification of the childhood activity of walking a rail fence or along the rails of a railroad track. Techniques similar to this have been used extensively in kindergarten and elementary school grades.

The primary function to be observed with the walking board is that of balance. Postural flexibility can also be observed since the balance problem also creates a situation in which movements which cannot be predicted far ahead of time must be performed without losing basic postural adjustment. Laterality is involved in maintaining balance and is developed when the child is asked to walk the board in the sidewise directions. Spatial orientation and spatial projections are required when the backward direction is introduced.
JUMPING

Further information concerning the child's ability to maintain balance and posture can be obtained when he is required to perform against the pull of gravity. The easiest method of observing such activities is through the use of hopping, skipping, and jumping performances. The activities selected are designed to indicate how well the child can maintain control of his body when he is required to move symmetrically, to move with each side alone, and to move alternately between sides.

The tasks are also designed to develop bilateral movement, unilateral movement, and alternating movements. In order to perform at an acceptable level, the child must demonstrate laterality, body image, rhythm, and the neurological controls related to each of these factors.

TRAMPOLINE

The trampoline offers the instructor an effective way to develop general postural adjustment and balance. The child who experiences difficulty in moving in the backward direction and who cannot perform balancing activities without watching his feet can be greatly aided by the trampoline. In order to control his gross musculature it is essential that the child develop a sense of rhythm in his movement. The child who shows a weakness in this area can be expected to profit from rhythm training and from
trampoline training where special attention is paid to the establishment of a rhythm in body movement which is matched to an outside rhythm, the movement of the bed of the trampoline. Apart from its contribution to the motor development of the child, the trampoline exerts a strong motivational force and is a source of enjoyment to the child.

IDENTIFICATION OF BODY PARTS

Body image is determined by the child's ability to identify parts of his body. Two general areas of knowledge are involved. The first is an awareness of the existence of the parts of the body and their names. The second area is awareness of the precise location of parts. Difficulty in this area is shown by the child who can start in the general direction of the part but must experiment or "feel around" to make final contact. He is not aware of the exact location in space of the part. Such a child may be aided by training techniques designed to call attention to the parts of his body and their location or control. Such activities as "Angels-In-The-Snow" will be found helpful.
SAMPLE OF A LESSON PLAN USED IN THE
MOTOR ABILITY SKILLS TRAINING PROGRAM

Motor Skills Training Program

WEEK OF: March 9-13
INSTRUCTOR: H. Lendvoy

Body Exercises (5 minutes)
1. Sitting to standing.
2. Lie on floor on stomach and get up by putting hands on floor and jumping up.
3. Obstacle run.
4. "Angels-in-the-Snow".

Balance Exercises and Trampoline (20 minutes)
1. Forward, sidewise, backward on walking board.
2. Ball bounce and catch on the balance board.
3. Trampoline: (a) bounce on one foot; (b) bounce and turn 180 degrees in air.

Games (10 minutes)
1. Relay using walking boards, gym set, ladders, and mats.
APPENDIX B

RAW SCORES

GENERAL MOTOR CAPACITY TEST SCORES

SUBJECT: Douglas B.

SCORES MADE ON INITIAL TEST:

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<td>Squat-Thrust Test:</td>
<td>4.0</td>
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</tr>
<tr>
<td>Iowa Brace Test:</td>
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<td>2.62</td>
</tr>
</tbody>
</table>

General Motor Capacity Score (GMCS): 148.08
Norm for General Motor Capacity: 170.14
Motor Quotient: 87.03

SCORES MADE ON FINAL TEST:

<table>
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<tr>
<th></th>
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<tbody>
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<td>RAW SCORE</td>
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<td>McCloy Classification Index:</td>
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General Motor Capacity Score (GMCS): 164.96
Norm for General Motor Capacity: 175.41
Motor Quotient: 94.04
SUBJECT: Kenneth C.

SCORES MADE ON INITIAL TEST:

AGE: 9-6  HEIGHT: 49"  WEIGHT: 67-1/2 lbs.

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<td>Iowa-Brace Test: 6.0</td>
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General Motor Capacity Score (GMCS): 156.43
Norm for General Motor Capacity: 174.60
Motor Quotient: 89.59

SCORES MADE ON FINAL TEST:

AGE: 9-10  HEIGHT: 52"  WEIGHT: 75 lbs.

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General Motor Capacity Score (GMCS): 181.04
Norm for General Motor Capacity: 187.17
Motor Capacity: 97.00
SUBJECT: Lynn F.

SCORES MADE ON INITIAL TEST:

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<tr>
<td>Iowa-Brace Test:</td>
<td>5.0</td>
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General Motor Capacity Score (GMCS): 55.98
Norm for General Motor Capacity: 59.09
Motor Quotient: 93.04

SCORES MADE ON FINAL TEST:

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<tr>
<td>Iowa-Brace Test:</td>
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General Motor Capacity Score (GMCS): 63.47
Norm for General Motor Capacity: 59.77
Motor Quotient: 106.21
SUBJECT: Neil H.

SCORES MADE ON INITIAL TEST:

AGE: 8-8   HEIGHT: 50"   WEIGHT: 57 lbs.

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<tr>
<td>Iowa-Brace Test:</td>
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General Motor Capacity Score (GMCS): 136.50
Norm for General Motor Capacity: 165.68
Motor Quotient: 82.39

SCORES MADE ON FINAL TEST:

AGE: 9   HEIGHT: 51"   WEIGHT: 58 lbs.

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<tr>
<td>Iowa-Brace Test:</td>
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General Motor Capacity Score (GMCS): 159.45
Norm for General Motor Capacity: 171.35
Motor Quotient: 93.00
SUBJECT: James J.

**SCORES MADE ON INITIAL TEST:**

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General Motor Capacity Score (GMCS): 166.84
Norm for General Motor Capacity: 173.79
Motor Quotient: 96.00

**SCORES MADE ON FINAL TEST:**

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<td>Iowa-Brace Test</td>
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General Motor Capacity Score (GMCS): 190.48
Norm for General Motor Capacity: 179.06
Motor Quotient: 106.32
**SUBJECT:** Stuart M.

**SCORES MADE ON INITIAL TEST:**

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General Motor Capacity Score (GMCS): 180.22
Norm for General Motor Capacity: 177.03
Motor Quotient: 101.80

**SCORES MADE ON FINAL TEST:**

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General Motor Capacity Score (GMCS): 190.62
Norm for General Motor Capacity: 181.90
Motor Quotient: 104.24
SUBJECT: Deborah W.

SCOR ES MADE ON INITIAL TEST:

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SCOR ES MADE ON FINAL TEST:

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SUBJECT: Randy Y.

SCORES MADE ON INITIAL TEST:

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General Motor Capacity Score (GMCS): 162.85
Norm for General Motor Capacity: 201.76
Motor Quotient: 80.71

SCORES MADE ON FINAL TEST:

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General Motor Capacity Score (GMCS): 175.27
Norm for General Motor Capacity: 209.87
Motor Quotient: 83.51
FROSTIG VISUAL PERCEPTION TEST SCORES

Key to Abbreviation:

<table>
<thead>
<tr>
<th>E.M.</th>
<th>F.G.</th>
<th>F.C.</th>
<th>P.S.</th>
<th>S.R.</th>
<th>P.Q.</th>
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</thead>
<tbody>
<tr>
<td>Eye-Motor Coordination</td>
<td>Figure-Ground</td>
<td>Form Constancy</td>
<td>Position in Space</td>
<td>Spatial Relations</td>
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Initial Test Scores:

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<th>E.M.</th>
<th>F.G.</th>
<th>F.C.</th>
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<th>P.Q.</th>
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</thead>
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<tr>
<td>Douglas B.</td>
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Final Test Scores:

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<th>F.C.</th>
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