THE EFFECT OF SPECIAL TRAINING IN MOTOR SKILLS
ON THE READING ABILITY OF GRADE TWO PUPILS
WITH SPECIFIC READING DISABILITY

by

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ABSTRACT

The purpose of this study was to investigate the effects of special training in motor ability skills on the reading ability of grade two pupils who have a specific reading disability.

Thirty subjects, all of them grade two pupils at the Sir Richard McBride Elementary School in Vancouver, British Columbia, were selected. All were classed as poor readers on the basis of the Metropolitan Reading Achievement Test.

The subjects were given pre-training standardized tests in Mental Ability, Reading Achievement, Visual Perception, and General Motor Capacity. They were then randomly assigned to five sub-groups for Special Training purposes. Group I was the control group. Group II received extra instruction in motor skills and reading. Group III were given special training in motor skills. Group IV received extra reading instruction, and Group V received special training in both reading and visual perception. The thirty subjects were equally distributed, six in each group.

The experimental groups received approximately fifty minutes of special training every day for a period of sixty-five days. Case Studies were made of the six subjects in Group III, the Motor Ability Group. At the conclusion of the Special Training Period, all subjects were again tested in
general motor capacity, visual perception, and reading ability. Initial and final test scores in motor capacity, perception, and reading were analysed by Fisher's t statistic and the differences between mean improvements of the five groups were discussed. Case Study Reports were written for each of the subjects in Group III.

A review of the Case Study Reports revealed that all of the subjects in the Motor Ability Group improved in reading ability, visual perception, and motor skills.

The group mean scores, before and after training, indicated that children who received special training in motor skills (Group III) improved in reading ability as measured by the Metropolitan Reading Achievement Test, but no more than children in any of the remaining groups. It appears also that special training in motor ability skills can cause an improvement in the motor ability and visual perception of children at this age level.
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CHAPTER I

STATEMENT OF THE PROBLEM

In our society, the acquisition of knowledge depends largely on the ability of the individual to read. Any condition that interferes with the ability to read is a serious handicap.

A reading disability is not as apparent as a physical disability such as a congenital hip or a club foot, and is often neglected for too long a time. The number of poor readers in our schools indicates that reading problems are not receiving adequate attention and treatment.

An uncorrected defect may lead to further deviations, particularly emotional and behavior problems. The early recognition and appropriate treatment of a reading defect is a matter of great importance.

This study is concerned with children who are essentially normal, i.e., with normal hearing, vision, and intelligence, - but who cannot learn to read with normal proficiency. This condition is known as specific reading disability.

A specific reading disability may not be apparent until the child is in the second grade. Before this time, both the normal reader and the child who has a specific
disability may make the same errors in reading. What distinguishes the child who has a specific reading problem is the frequency and the persistence of these errors well beyond the time at which they become uncommon in normal children. Research studies have shown that the child whose reading achievement is two or more years below his grade placement and/or mental age is to be considered a "poor" reader.

This problem of specific reading disability is universal. It is a matter of prime concern to educational leaders in all areas of this country. Those responsible for the education of the children of Vancouver are constantly seeking remedies for specific reading disabilities. The Special Programmes Branch of the Vancouver School Board is continually experimenting with methods of detecting and correcting those pupils who have specific reading disabilities.

At the suggestion of Dr. E.N. Ellis, Research Supervisor of the Special Programmes Branch of the Vancouver School Board, this study was undertaken to investigate the effects of special training in motor skills on the reading ability of grade two pupils with specific reading disabilities.

The study is limited to thirty pupils in the Sir Richard McBride Elementary School (hereafter referred to as the "McBride School"), located on East 29th Avenue, Vancouver, British Columbia. The hypothesis of the study is that these
children, all of whom are classed as poor readers, will, by taking part in a special motor skills training program, show significant improvement in reading ability.
CHAPTER II

JUSTIFICATION OF THE PROBLEM

What is the magnitude of the problem of specific reading disability? How many children are defective readers and where are they to be found? If answers to these questions are to be given, we must first consider methods of measuring reading competence.

Surveys of reading performance are based upon group tests of reading such as the Iowa, Stanford, California, Gates, and others. Typically, the test is standardized by scoring the results of its administration to a sample of children drawn from selected and presumably representative communities. Practical considerations determine that the test must be given to groups of children rather than individually administered. The test must be relatively brief in order to avoid fatiguing the child. Scoring must be simple; thus there is reliance on multiple choice answers which permit machine scoring. The skills measured by the elementary reading tests are different from those demanded for successful completion of the intermediate and advanced tests. At the lower levels, little more is required from the child than the ability to decode the visual symbols into recognizable words. At intermediate and advanced levels, comprehension is called much
more directly into play; in consequence, performance will vary with vocabulary, level of reasoning, and general intellectual facility.

With these general considerations in mind, let us look at the facts and figures for a 1964 survey of reading performance on the Stanford Test of the entire sixth-grade population of a large city in the eastern United States (1). The data are based on 12,000 children (children in special classes for mental retardation are not included). On the abscissa are plotted reading scores by half-year intervals; on the ordinate the percentage of the total sample scoring in each range. The figures show that twenty-eight per cent of the sixth-grade children are reading two or more grades below expected grade level, the conventional definition of severe reading retardation. With a median reading level of 5.2, the distribution is shifted significantly to the left; by definition of test construction, the median should lie at 6.5. The epidemiological significance of these data can be heightened by comparing them with those from other population groups in the same area. Figure 2 plots the reading scores for city (urban) public school children, for "suburbia" dwellers, and for children attending independent (private) schools in the city. So great are the differences that one could almost believe three different biological populations are represented; yet
GRADE 6.5 READING LEVELS IN METROPOLIS (STANFORD TEST - 1964)
the potential of the city school children is not significantly different from that of the suburban or the independent school children.

A similar reading test (the Metropolitan Achievement Reading Test) was given to the one hundred and nine grade two pupils at the McBride School in Vancouver, British Columbia, in September, 1966. Of this test group, forty-two children achieved scores lower than 3.0, the standard score accepted in the Vancouver schools to designate reading competence.

From these facts and figures, it is evident that some elementary school children do have a reading problem. In most cases such children are in a relatively good state of health, are not mentally retarded, are free from neurological disorders, and have good hearing and adequate vision. In other words, as stated earlier, these children have what is known as a specific reading disability.

Further explanation and investigation into the meaning and nature of the term "specific reading disability" will be made in the next section of this report. For the moment, it is sufficient to state that the condition does exist, and perhaps in more of our children than we may be aware. The problem is, what can be done about it? If these unfortunate individuals are to achieve some measure of success in their academic endeavours, if they are going to progress at a normal
rate of advancement in school, something must be done to help them.

The investigator believes that, in many instances, the underlying cause of specific reading disability is the lack of development of basic sensory-motor skills. Studies by Kephart (2) indicate that the development of form perception, so important to the beginning reader, depends upon the adequate learning of basic sensory-motor skills. Frostig and Horne (3) point out that a child with defective or poorly developed visual-motor coordination may be unable to dress himself without clumsiness; he will probably be unable to match his schoolmates in sports and games; the non-academic skills such as cutting, drawing, and colouring, are likely to prove difficult for him; and he will certainly have difficulty in learning how to read and write.

If, as the investigator assumes, one of the basic reasons for reading retardation is a need for more adequate development of sensory-motor skills, the solution is an obvious one: the provision of special training in those basic motor skills that stress the development of laterality, directionality, dominance, coordination, balance, and other kinesthetic functions in children.

This indirect approach to the remedial aspects of the problem of specific reading disability is not by any means a
unique one. In addition to the important work being done by researchers such as Kephart, Frostig, and Rabinovich in this area, others, such as Jeralyn Plack, of the University of Minnesota, have recently reported finding a high correlation between selected motor skills and reading in children of grades one, three, and five (4).

In summing up, it is evident that there is a need today to discover ways and means of improving the reading ability of children who have a specific reading disability. The investigator believes that the bases for many of these reading problems lie in the inadequate development of functional motor skills. Without adequate form perception, a child will find it difficult, if not impossible, to learn to read properly. The development of adequate form perception depends upon the adequate learning of basic sensory-motor skills.

By conducting case studies of six pupils at the grade two level of schooling, all of whom have a specific reading disability, the investigator proposes to demonstrate, through training, testing, and observation, that there is a definite relationship between motor skills and reading ability.
REFERENCES


CHAPTER III

REVIEW OF THE LITERATURE

As defined by Klapper (1), reading is an active process involving a learned reaction to symbols. Our phonetic alphabet system, as a highly developed symbol-sound system, places a great demand on intersensory organization for its mastery. English symbols are not ideographs or syllabaries, but are like algebraic symbols because they are so far removed from the object or idea they represent - the single letters are connected with sounds through conventional use. To learn to read English a child must be able to deal with letters and words, in themselves not easily distinguishable from each other, except by little irregularities or changes in position, e.g., "N" and "M"; "d" and "b"; "p" and "q", arranged in certain sequences, and arbitrarily associated with certain sounds.

Learning our English alphabet system involves some of the processes which underlie the reading (interpretation) of pictographic and ideographic writing; however, the complex mental processes essential to the mastery of our phonetic alphabet are unnecessary in learning to read pictographs such as a road sign or a dollar sign. There probably is no age specificity in reading training at the ideographic level; any child who can see should be able to identify ideographs. We
know that young children correctly distinguish phonograph record labels; proudly name familiar signs; and can often be trained to recognize their own name, or the word "dog", and so forth. These are words to us; they are ideographs to the three-year old. The ideographic reading style of the very young child probably cannot be replaced by phonetic reading until there is the appropriate developmental level of organization. If the child experiences reading difficulty, it may not appear for the first time until the second grade, because an ideographic learning style, adequate for pre-primer and primer reading, is not sufficient for mastery of traditional reading skills.

The present study is concerned with the child who hears well, whose vision is intact, whose general intelligence is normal, but who, nonetheless, is unable to learn to read with normal proficiency. This condition is known as specific reading disability.

A review of the literature reveals a multiplicity of names for this disorder: congenital word blindness, primary reading retardation (2), developmental aphasia, strepto-symbolia, and developmental dyslexia (3). (For the sake of convenience, we will use the term dyslexia.)

The adjective "specific" calls attention to both the nature of the disability and to medical science's ignorance as
to its cause. Specific reading disability is defined by Critchley as "the failure to learn to read with normal proficiency despite conventional instruction, a culturally adequate home, proper motivation, intact sense, normal intelligence, and freedom from gross neurological defect" (4).

There are no reliable data on which to base a secure estimate of the prevalence of specific reading disability; such surveys as exist record only the extent of retardation in reading on group tests without differentiation as to cause. Clinical reports indicate a much higher rate of occurrence among boys, the male-female ratio generally being four to one. This disproportion is similar to, but higher than, the surplus of boys among retarded readers from all causes, among children regarded as academically backward, and among children referred to psychiatric clinics (5). Boys in general are slower to acquire verbal facility and are more prone to exhibit "immature" behaviour in the early school grades.

Once reading difficulty has been established, it is important to be able to determine the type of reading error. In most cases of specific reading disability the child will confuse letters that look alike (p and q, d and b) as well as those that sound alike (d and t, b and v). Reversal tendencies are likely to be prominent. The child may have great difficulty with short words which are anagrams of one another
(was and saw, on and no, for example), whereas he may do perfectly well with polysyllabic words. In reading he will substitute invented words for those he cannot read or guess from the context of the sentence. He may read a word correctly and then fail to recognize it completely a sentence or two later. These very same errors occur in the normal child who learns to read; what distinguishes the dyslexic is the frequency and persistence of these errors well beyond the time at which they have become uncommon in the normal. The persistence of large numbers of these errors beyond the second grade is strong indication of specific reading disability problems. Rabinovitch, et al. (6) concluded that the child whose reading achievement is two or more years below his grade placement and/or mental age is to be considered a retarded reader.

Given a child with retardation in reading, we must inquire as to his general intellectual level. The mentally deficient child will inevitably have difficulty in learning to read because of his limited ability to deal with symbols and abstractions. If the report of the child's I.Q. is based on individual or group testing, the poor reader, penalized by his handicap, is likely to show a discrepancy between his verbal and performance scores, with the latter fifteen to twenty points higher. The performance score may be regarded as a
more valid indication of intellectual potential (7).

Having excluded mental defect as the cause, we turn to the child's history of school attendance for evidence as to the adequacy of his school experience. Frequent and prolonged absences from school, conspicuously poor teaching, or lack of motivation from the home for academic achievement may account for his failure to learn despite normal intellectual endowment.

We next consider sensory defect, visual or auditory. Moderate sensory defects rarely provide a decisive barrier to learning to read. Only the grossest visual pathology, reducing acuity by as much as fifty per cent is likely to interfere with the acquisition of literacy. The difficulty of the child with specific reading disability is not one of visual perception, but rather of the interpretation of symbols. "Not the eye, but the brain learns to read" (8).

What of the results of a neurologic examination (9)? Where there is unequivocal evidence of brain pathology, the primary diagnosis is acute or chronic brain syndrome; there is a symptomatic manifestation, presumably due to injury to the supramarginal or angular gyri of the dominant hemisphere. In contrast, the child with specific reading disability has no post history of injury to the brain; there are no gross signs of neurologic defect. The adjective "specific", therefore, conveys not only the circumscribed nature of the handicap, but
as well the lack of common agreement as to its cause.

The underlying disturbances in dyslexia can be viewed as "the disordered processing of sensory information". According to Klapper (10), three regions of impaired functioning may be considered: (1) inadequate processing of sensory information in a single channel, particularly if arrangement in sequence is involved; (2) impaired coordination and integration of information arriving as input from two or more different sensory modalities; and (3) deficient cognitive functioning, restricting the use of spatial, directional, or temporal information. It is this latter region that is particularly related to the purposes this study.

Mastery of reading skills depends on effective cognitive adaptation to the special properties of the graphic symbols. A constancy in the identity of a graphic symbol must be developed and maintained, in spite of changes in its size, position, or shape. Constant changes do appear, however, in the arrangement of letters and words, and the letter forms. Letters like "0" and "X" are seldom confused, but "p" and "b" and "d" could be regarded as the same symbol, placed in different positions. In normal readers, effective relational concepts are evident by age seven. But in many instances of reading disability, deficiency in such functions is manifest. Dyslexics have to struggle with the problem of orientation and
position of verbal symbols. Even if they read at a laboriously slow pace they make characteristic errors and reversals, such as right-left reversals ("b" for "d") and near-far reversals ("b" for "p") which Orton (11) calls static reversals ("saw" for "was"). Normal children may also make word reversals but, as Money (12) points out, the dyslexic is unique in making so many of them for so long a time.

Right-left disorientation has been suggested by several authors (13, 14, 15) as the underlying disturbance in reversals. Right-left orientation is not a simple process. Normal children distinguish right-left relations on their own bodies and on someone else's by the age of seven, but their ability to distinguish lateral directional positions of three objects on a table does not stabilize until age eleven (16).

Laterality must be distinguished from handedness and from the naming of right and left. Laterality is an internal awareness of the two sides of the body and their difference. It is probable that when a child has learned the sides, he still has to solve the problem of keeping their relationships straight. It seems possible that he learns to do this by developing one side as the leading side and consistently leading with this dominant side. Such a learning process may lead to dominance and, among other things, handedness. In this connection, it is significant that studies of young
children have shown that handedness develops. It is not innate, but appears to develop somewhere around the age of two years. Gesell (17) and others have noticed this phenomenon. Previous to this time, the child uses his hands alternately and appears to have no consistent choice.

In like manner, laterality must be differentiated from the naming of sides. To ask the child to identify his right hand does not constitute a test of laterality. The recognition of the right hand as opposed to the left hand can be based on external characteristics of the two parts. The development of laterality is extremely important since it permits us to keep things straight in the world around us. The only difference between "b" and "d", then, is one of laterality. If there is no left and right inside the organism there can be no projection of this left and right outside the organism, and consequently the directional characteristics of "b" and "d" disappear.

In younger dyslexics, there is more disturbance in right-left orientation than in older children, but dyslexics as a group show only slightly higher right-left disorientation in identifying parts of the body, than do normal readers of similar age. However, if the dyslexic is asked to judge the directional laterality of objects, there is greater disorientation than is found in the normal reader, suggesting that
those judgements require higher order mental processes than right-left designations of parts of the body (18).

Disturbances in right-left orientation are symptoms of disturbed conceptualization, in the same sense as reversals are. This difficulty which dyslexics have in establishing concepts has been noted by most authors. Rabinovitch (19) has developed a Hawthorne Concept Scale for dyslexics in line with the recognition of this problem.

There are two broad categories of remedial reading techniques into which most current approaches can be divided. The first is the direct educational approach, and consists of training primary reading skills by directly approaching the subject-matter words as sound symbols. Many schools of thought have influenced the direction of this training, examples of which are: the phonic approach, which directs the child to break down words into sound elements; the sight-word method, employing visual associative memory of the whole word; and a kinesthetic look-hear-say method, in which the child hears the word, says it, and traces it at the same time. The remedial application of these techniques is in small groups, or individual cases, separate from the classroom.

The second broad category of remedial techniques departs from teaching reading directly, and instead approaches the reading disability indirectly. Improved performance in
other deficient areas of functioning, assumed to be related to the mastery of reading skills, is the immediate training goal.

One method of special training for dyslexics, recommended by Kephart (20) and others, stresses the development of laterality, directionality, and dominance through the improvement of motor skills and coordination. Kephart points out that the development of adequate form perception, so important to the beginning reader, depends upon the adequate learning of basic sensory-motor skills:

"Our first information about form and about spatial relationships involved in form is kinesthetic and tactual. We must learn kinesthetic laterality before we can proceed to visual form."

This laterality must be projected outside the body in forms of directionality before we have a basis for maintaining the relationships involved in form. These basic skills are necessary in order to ensure that the relationships involved in a form are presented to the child and are responded to by him in a consistent manner.

An example of this type of remedial training is the use of the walking board. The primary purpose of this apparatus is to aid in teaching the child balance and postural responses. Maintaining balance on the board requires an accurate knowledge of the difference between the right side of the body and the left. The technique thus aids in the
development of laterality. As we have seen, laterality is necessary in reading, where a left-to-right progression across the line of print must be sustained. It is probable that many reversals of words or letters are due to inadequate laterality. Similarly, a child's experiences of right, left, up, down, far, and near are kinesthetically accentuated by guided physical activities such as springing on a trampoline, catching or bouncing a ball, and balancing on balancing boards. This approach is considered by its proponents as potentially therapeutic for dyslexia and has been reported to be successful with individual cases.

Contrary to usual findings of low positive correlation between motor skills and academic achievement, Jeralyn J. Plack of the University of Minnesota, at the 1966 National Convention of the American Association for Health, Physical Education, and Recreation, reported a high positive correlation between selected motor skills and reading in children of grades one, three, and five. Using one hundred and seventy-two subjects, reading achievement was determined by the Iowa test of Basic Skills, and motor skills were determined by the Johnson Motor Achievement Battery. Highly significant correlations were obtained between achievement in reading and the throw and catch, and the zig-zag run test (21).

The role of transfer of training, the effect of the development of body tone or body-awareness through physical
exercises, the development of compensatory mechanisms for organizing sensory impressions, all are in need of further investigation. There is no sound basis, from a scientific point of view, for recommending any one of these remedial approaches to dyslexia. They all have in common, however, one important and essential ingredient - an individual training program, apart from the regular classroom, conducted by a teacher who has training, enthusiasm, sympathy, and confidence in his techniques (22).
REFERENCES


4. Ibid., p. 3.


CHAPTER IV

METHODS AND PROCEDURES

During the month of September, 1966, the entire grade two population (one hundred and nine pupils) of the McBride School were given the Metropolitan Reading Achievement Test, Primary II Battery, Form "T". This is a standard reading test for children at the grade two level (1).

At the same time, these pupils were scored on their performance in the Alpha Section of the Otis Mental Ability Test (2). This test has a reliability coefficient of .87, and, when correlated with the Metropolitan Achievement Test for Reading, its correlation coefficient is .68.

From the results of the reading and intelligence tests, thirty (30) pupils were selected as potential subjects for the study. These selections were based on the following factors:

(a) The subject must not be a repeater of the grade two level of schoolwork;

(b) The subject must be between the ages of six years, ten months, and seven years, seven months as of the date of the Reading Test;

(c) The subject must be in the low achievement range (average rating of 2.7 or below) on
the Reading Ability Test;

(d) The subject must be in a relatively good state of health, specifically, a body free from disease, not mentally retarded, free from neurological disorders, and having good auditory sense and visual acuity in excess of 50%.

Although an attempt was made to limit the subjects selected to a definite Intelligence Quotient range, this was found to be impossible if a total of thirty subjects having characteristics (a) to (d) was to be obtained.

The thirty subjects were then given two additional tests considered by the investigator to be fundamental to the study.

(1) The Frostig Developmental Test of Visual Perception (3)

This test establishes a child's level of performance in each of five areas of visual perception. The current (third) edition of this test was standardized on more than 2,100 children. Based on the Perceptual Quotient, the test-retest reliability estimate, a product-moment correlation coefficient for the entire sample, was .80.

The results of the reliability-validity studies made by Frostig indicate that between the ages of three and-a-half and seven and-a-half years, visual perception is a child's
major developmental task. There is not just one visual perceptual ability, but several, each of which develop relatively independently of each other and in varying degrees.

The Frostig Test may be administered individually or in groups; for this study, the Test was administered to the subjects in pairs by Mrs. E. Sharpe, Special Education Instructor at McBride School. Scoring on the Test is objective. The child's raw score for each sub-test was converted to a perceptual age equivalent, representing the age at which the average child achieves this score. The total perceptual quotient (P.Q.) was then derived in a manner similar to that used for determining an intelligence quotient (I.Q.).

(2) The Carpenter General Motor Capacity Test for Children in the First Three Grades (4)

Designed by Dr. Aileen Carpenter in 1942 specifically for children in the lower elementary grades, the total score (GMCS) obtained on this test may be used as a measure of the child's motor capacity. McCloy defines motor capacity as "the motor analogue of the raw score of an intelligence test, which is usually expressed as mental age" (5).

The Carpenter Test consists of four parts:

(1) Classification Index (age x 20 + height x 6 + weight);
(11) Sargent Jump (the distance in centimetres between the
top of the reach mark and the top of the highest jump mark);

(iii) Squat-Thrusts (total number completed in ten seconds);
(iv) The Iowa-Brace Test (consisting of six stunts suitable for children of the first three grades).

Following are the Regression Equations for computing the general motor capacity (GMC) of pupils in elementary school in the first three grades.

**Boys**

\[
GMC = 0.181 \text{(Classification Index)} + 0.769 \text{(Sargent Jump in cms.)} + 0.510 \text{(Brace Test score)} + 2.187 \text{(Burpee Test)} - 62.
\]

**Girls**

\[
GMC = 3.576 \text{(Sargent Jump in cms.)} + 2.20 \text{(Brace Test score)} + 19.12 \text{(Burpee Test)} + 29.
\]

**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 Motor Quotient. This quotient is the motor analogue of the I.Q. score used in the measure of intelligence. The score, based upon the Classification Index for boys, and on age for girls, represents the individual's motor capacity relative to size and general maturity.

The investigator found that this General Motor
Capacity test was one of the few available in the research suitable for the age group under study.

**Administration of the Carpenter General Motor Capacity Test**

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

1. Each of the five experimental groups was tested in turn, beginning with Group I.

2. Each subject in the group was weighed and measured for height, using the weight and height scales 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.

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

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

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

6. For the Squat-Thrust test, the subject was permitted only one official trial. A stop-watch was used to time the trial. The total number of squat-thrusts completed by the subject was recorded.

7. The Iowa-Brace test consists of six motor ability stunts. Each stunt was demonstrated to the subject by the instructor. The subject then was allowed one practice try. If necessary, the stunt was again demonstrated, and the subject attempted the stunt. 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 minimum of five seconds.

   (ii) **One-Knee Balance** - subject balances on one knee with other leg held straight back and off the floor; arms are held out to sides; position must be held for five seconds.

   (iii) **Cross-leg Squat** - from crossed-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 was required to jump off the balanced foot, complete a 180° turn, and land on the same foot; losing balance, touching other foot to floor, or failing to execute a complete 180° turn constituted 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.

**Scoring on the Iowa-Brace Test**

The subjects were scored on the Iowa-Brace Test in the following manner: two (2) points awarded for the successful completion of each stunt on the first trial; one (1) point awarded for success on the second trial; no points awarded for failure to execute stunt in two tries. Perfect score for test is twelve (12) points.

During the administration of the Iowa-Brace Test, one instructor demonstrated, explained, and guided the subjects in each test item while the second instructor evaluated the
subjects' performances and recorded the results on specially-prepared score sheets.

Selection of Experimental Groups

The group of thirty selected subjects was subdivided into five experimental groups. In constructing these five groups, a random selection was used. The five groups, with six subjects in each, were assigned as follows:

Group I (Control Group). This group received no special training of any kind.

Group II (Motor Ability and Reading). This group received twenty-five minutes of special motor skills training and twenty-five minutes of extra reading ability instruction every day (Monday to Friday inclusive) for a total period of thirteen weeks.

Group III (Motor Ability). This group received fifty minutes of special motor skills training daily (Monday to Friday) for thirteen weeks.

Group IV (Reading Only). This group received fifty minutes daily of extra reading ability instruction (Monday to Friday) for thirteen weeks.

Group V (Reading and Perception). This group received twenty-five minutes of extra reading ability instruction and twenty-five minutes of special training in visual perception daily (Monday to Friday inclusive) for thirteen weeks.
Motor Ability Skills Training

Groups II, IV, and V all received special training in reading and/or perception. This part of the Special Training was given to the subjects concerned by Mrs. E. Sharpe, Special Education Instructor for the McBride School.

The investigator was principally concerned with the special training and test results of the subjects in Group III. It is this group with which he was most actively involved (as instructor) during the training period (thirteen weeks), for approximately one hour of special training in motor ability skills each day. In addition, a case study was made of each of the individual subjects in Group III. (Case Study Reports for each individual subject in Group III may be found in Chapter V).

In order to better assess the particular individual perceptual-motor abilities and needs of each subject in Groups II and III, each subject in these two Groups was given a series of motor performance tasks to perform. These are tasks devised by Kephart (6) to permit the observation of a child's perceptual-motor behaviour. These tasks are listed in Appendix "B" of this report. The nature of the tasks permit observation and assessment of the child in a relatively short period of time and without the use of complicated devices and apparatus. This close observation of the child's performance
permits the instructor to identify his level of development and to make a preliminary selection of training methods which will aid him.

From the results obtained from the Kephart Motor Behaviour Evaluations, the investigator used training methods designed to correct or improve the specific inadequacies of each individual subject in Group III.

Generally, these inadequacies were found most often in the following areas: hand-eye coordination, posture, balance, laterality, directionality, and body image. From these subjective observations, the investigator listed specific exercises and tasks which would be helpful in training the subjects in Groups II and III. The List of Stunts, Exercises, and Games for the training and improvement in perceptual-motor ability skills may be found in Appendix "B" of this report.

All of the special motor ability training periods were conducted in the Special Programmes classroom at the McBride School. The furniture and equipment of this room were arranged so that the special perceptual-motor training tasks and exercises could be performed with a maximum freedom of movement and expression by the subjects. Some of the more helpful pieces of equipment and apparatus used were: bean bags, a 9' x 12' trampoline, walking boards, balance boards, rubber balls, a climbing ladder, hoops, and moveable school desks.
For each day of special motor ability training, the investigator composed a Lesson Plan based on the Special Motor Ability Exercises and Tasks. A sample copy of a typical Lesson Plan is included in Appendix "B". Many of the specific exercises and tasks used in the motor ability training were repeated numerous times during the course of the training period, as the subjects' ability in certain motor ability skills could only be improved by constant repetition.

The period of special training in motor ability skills covered a total of thirteen weeks, beginning November 21, 1966 and terminating March 10, 1967. During this time, the training routine was interrupted for a period of three weeks (December 17, 1966 to January 8, 1967) to allow for school examinations and Christmas holidays.

Final Testing

At the conclusion of the special training period, the twenty-five children remaining from the original group of thirty subjects (five subjects had left school during the training period for various reasons) were again given the Frostig Developmental Test of Visual Perception and the Carpenter General Motor Capacity Test. In addition, the entire grade two population of the McBride School, including the twenty-five pupils selected for the Study, repeated the same Metropolitan Reading Achievement Test that they tried in September, 1966.
The results of these various 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 Chapters V and VI of this report.
REFERENCES


CHAPTER V

CASE STUDY REPORTS OF GROUP III SUBJECTS

Key:  I.Q.: Intelligence Quotient
M.Q.: Motor Quotient
P.Q.: Perceptual Quotient
Read. Comp.: Reading Comprehension
Read. Vocab.: Reading Vocabulary
Ave. Read.: Average Reading Ability

SUBJECT: Donn A.  AGE: 7 years, 2 months
HEIGHT: 49-1/4"  WEIGHT: 46-1/2 lbs.  I.Q.: 107

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<td>8 - 0</td>
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<td>8 - 10</td>
<td>3.9</td>
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<tr>
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<td>+19 mos.</td>
<td>+10 mos.</td>
<td>+1.2</td>
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Homeroom Teacher's Comments:

"Donn is very quiet, enjoys attention, is rather dependent. He works slowly, is inclined to daydream. His schoolwork is untidy. He appears to have few close friends, usually keeps to himself, and seems afraid to get involved in anything."
Investigator's Comments:

"Donn is polite, attentive, and tries hard to learn new skills. He appears to enjoy physical activity and games. At the beginning of the training period, his physical performance was slightly below average. On both the General Motor Ability Test and the Kephart Perceptual-Motor Behaviour Evaluation, he was below average. Initially, Donn demonstrated a poor sense of balance and a hesitancy towards physical tasks on the balance boards, walking boards, and trampoline. However, after a few weeks of training and practice, he became much more proficient and confident in these areas. His motor ability increased by six points; he showed a gain of twelve points in visual perception; and his reading ability has improved by eighteen months in comprehension and ten months in vocabulary."
SUBJECT: Phillip E. AGE: 7 years, 4 months

HEIGHT: 44-1/2" WEIGHT: 38-1/2 lbs. I.Q.: 109

Initial Test: 94 103 7 - 10 7 - 8 2.5
Final Test: 108 121 8 - 7 7 - 11 3.0
Difference: +14 +18 + 9 mos. + 3 mos. +.5

Homeroom Teacher's Comments:

"Phillip was an extremely shy child at the beginning of September. But lately he will talk and answer questions. He tries to join in and likes to take part. He doesn't really have any close friends at school. He is very sensitive and doesn't like criticism. For awhile he would not ask to leave the room and had several accidents. But has overcome that. He is still not outgoing but has come out of himself very much of late. Phillip speaks Chinese at home. His mother doesn't speak English and his father speaks very little.

"Phillip tries hard, but most times does not understand a lot of the directions I give. He won't ask if he doesn't understand. His work is neat and he has some control of his pencil but more is needed."

Investigator's Comments:

"At the start of the training program, Phillip was very quiet and reticent. He had a definite language barrier,
and it was difficult to judge his performance because he could not always understand spoken instruction. By February, Phillip had improved tremendously. He now appeared to have little difficulty understanding the instructions given, and he communicated with the other subjects freely and easily. He became one of the better leaders in the body parts identification games. Phillip showed improvement in all the motor ability skills in the training program, particularly in trampoline performance. This improvement is reflected in his gain of fourteen points in the motor ability score. In addition, Phillip showed marked improvement in perceptual skill (eighteen points), and gained nine months in reading comprehension and three months in reading vocabulary."
SUBJECT: Cindy F.  AGE: 7 years, 10 months
HEIGHT: 49-1/2"  WEIGHT: 50-1/2 lbs.  I.Q.: 87

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<td>7 - 7</td>
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<tr>
<td>Final Test:</td>
<td>106</td>
<td>108</td>
<td>8 - 10</td>
<td>8 - 4</td>
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<tr>
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<td>+16</td>
<td>+21 mos.</td>
<td>+9 mos.</td>
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Homeroom Teacher's Report:

Oral Reading: "Cindy's oral reading is much better than it was last fall. She now reads in phrases and with understanding. She is becoming a more fluent reader now that she can successfully 'sound out' troublesome words. Also, she enjoys reading to her peers now and shows no embarrassment.

Silent Reading: "Retention of facts is quite good and she can successfully read to find specific answers. Guide reading presents no problems for her either.

Phonetic Skill: "Cindy is able to blend sounds together to discover new words. Occasionally, this blending process takes time and interrupts her oral reading. Her retention of basic vocabulary is average.

Spelling: "In the unit lessons, she seldom gets more than two errors. It takes her a little longer to print her words, almost as though she printed the letters for the sounds.

Behaviour: "Cindy works well on her own and can be
depended upon to complete her work neatly and correctly."

**Investigator's Comments:**

"Cindy has shown steady improvement in motor ability during the Training Program. Her performance on the trampoline, balance boards, walking boards, and in rope skipping is excellent. Her coordination of body movements is very good. Slightly higher than the group average to begin with, her Motor Quotient rose by five points as a result of training. The relatively large increase in her Perceptual Quotient (from 92 to 108) indicates that extra training in motor skills had a definite effect on her perceptual abilities. During the Training period, Cindy's reading ability showed a distinct improvement, particularly in the area of reading comprehension."
SUBJECT: Grant H.        AGE: 7 years, 6 months
HEIGHT: 51-1/2"       WEIGHT: 68 lbs.        I.Q.: 97

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<td>Difference: +11 +22 +7 mos. +1 mo. +.3</td>
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Homeroom Teachers Comments:

Oral Reading: "His oral reading has shown improvement since last December. He now reads with greater fluency and with better understanding of phrasing. When reading to his peers, he is more confident about doing well than he was earlier in the term.

Silent Reading: "Grant can recall facts quite well when questioned immediately after an oral reading, but experiences difficulty when asked to do so the following day.

Phonetic Skills: "Grant knows all his isolated phonetic sounds, but has difficulty in blending sounds to form words, especially longer words like 'wondering' and 'screamed'. His retention of basic vocabulary is not very good.

Spelling: "Grant has many errors due to letter reversals, such as 'farm-fram', 'yard-yrad', 'dog-bog'. In spelling unit twenty-five, he had eight such errors. In his written work there are many spelling errors too. He doesn't use his phonics."
**Behaviour:** "Restless in class, is a nuisance to others around him. Attention span is not very long; becomes bored easily."

**Investigator's Comments:**

"At the beginning of the training program, Grant showed a deficiency in balance and coordination. He also revealed a distinct directionality problem, often confusing left from right, particularly in 'Angels-in-the-Snow'. He tended to be a 'follower' when participating in group activities. By the end of the Training Period, Grant had improved considerably in his physical performance, particularly in balance activities, and he had now become a 'leader' type in many of the activities. He still has a slight problem in differentiating between left and right. Grant's motor quotient increased eleven points, and his visual perception twenty-two points. Although he showed a decided gain in reading comprehension, his reading vocabulary showed little improvement."
SUBJECT: Mark M. AGE: 7 years, 5 months
HEIGHT: 50-1/4" WEIGHT: 62 lbs. I.Q.: 131

Initial Test: 93 116 7 - 4 7 - 0 1.9
Final Test: 101 121 8 - 4 8 - 6 3.1
Difference: +8 +5 +12 mos. +18 mos. +1.2

Homeroom Teacher's Comments:

Oral Reading: "He has shown a little improvement, especially in phrasing. Mark doesn't read too fluently; stumbles over many words. He does use his phonetic skills to discover words, but he takes a long time, consequently losing his thoughts about the paragraph.

Silent Reading: "He has difficulty remembering facts about a story. He seems to be aware of only the various obvious points. He has greater success when questioned immediately following a reading. Mark's vocabulary retention is below average, but he at least attempts to discover the word through phonic skills. This he didn't do before.

Phonics: "Mark still mixes up the 'th' and 'wh' sounds. He doesn't look carefully at his words when reading them; he will interchange 'p', 'b', 'd', 'b'. Often he will say house instead of home, come for came, and was for saw. Mark always seems to be in such a hurry; he doesn't have time to look at individual letters."
Spelling: "Oral spelling average; in a test though, he scores lower because he prints letters backwards, or leaves letters out. He won't use his phonics.

Behaviour: "Mischievious in class. Slow worker. He needs constant supervision. He is more interested in playing than in working. His only concern at the present is with the actual gym work. This he enjoys very much."

Investigator's Comments:

"At the beginning of the Special Training Program, Mark was very outspoken, loud, and aggressive. His headstrong behaviour affected his physical performance, so that what appeared to be a lack of motor ability was partially the result of attitude. However, with the proper discipline and motivation, Mark improved not only in physical performance, but in attitude and behaviour as well. By the end of the Program, Mark was the leader and superior performer in nearly every skill activity. Although his final scores in motor ability and perceptual tests showed some improvement, perhaps the most significant gain was achieved by Mark in reading, where final tests indicated an improvement of twelve months in reading comprehension and eighteen months in reading vocabulary."
SUBJECT: Samuel W. AGE: 7 years, 11 months

HEIGHT: 48-1/2" WEIGHT: 50-1/2 lbs. I.Q.: 97

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<tr>
<td>Difference: +5</td>
<td>+5</td>
<td>+12 mos.</td>
<td>+16 mos.</td>
<td>+1.1</td>
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Homeroom Teacher's Comments:

"Hard worker, mature approach, but finds reading skills hard work. Sam has always been most cooperative, and very attentive during lessons. However, he has considerable difficulty with language arts, though not from lack of applying himself. Mrs. Wilkie, who takes his P.E., says he has become the most proficient in his class in all P.E. skills, though he had coordination difficulties in Grade 1. Sam is thoughtful and considerate and a popular boy with his school mates."

Investigator's Comments:

"Throughout the training period, Sam was an excellent pupil, attentive, persevering, enthusiastic, and very well behaved. Perhaps more than any other subject in Group III, Sam displayed an exceptionally high ability to learn in motor skills. His ability to control his actions and behaviour is unusual for his age group. Sam proved to be easily the most
versatile performer in the group, and was exceptional in balance beam work and trampoline exercises. Sam's reading vocabulary and reading comprehension improved by twelve months and sixteen months respectively."
CHAPTER VI

RESULTS

The data obtained from the five experimental groups are summarized in Tables I, II, and III.

The statistical treatment deals with the significance of the differences between the correlated means of the initial and final test results in the three skill elements in each group. The three skill elements are: (i) Reading Achievement; (ii) Perceptual Performance; (iii) Motor Ability Performance. The five experimental groups are:

- Group I - the Control Group
- Group II - the Motor Ability and Reading Group
- Group III - the Motor Ability Group
- Group IV - the Reading Group
- Group V - the Reading and Perception Group.

A difference in means is called significant when the probability is high that it cannot be attributed to chance and hence represents a true difference. A difference in means is said to be non-significant when it appears reasonably certain that it could easily have arisen from normal fluctuations or chance.

For the purposes of this study, the Fisher's $t$ statistic in each of the analyses of the differences between
means was placed in one of three categories:

1. One category consisted of values falling below the .05 level of confidence;

2. A second category consisted of values which fell between the .05 and .01 levels of confidence;

3. A third category consisted of values which fell at or above the .01 level of confidence.

These categories were constructed without regard to the possible consequences of making errors of the first or second kind but were used solely to classify mean differences into different levels of reliability. Thus, results were considered as unreliable or non-significant if below the .05 level of confidence, significant or reliable at the .05 level of confidence, and highly reliable or highly significant at the .01 level of confidence. The two-tailed test was applied in all comparisons between means.

Determination of the significance of the difference between correlated means of the initial and final test results in the three skill elements for each group is outlined in Appendix "A" of this report.

Table I summarizes the differences in the mean performance of each of the five experimental groups in the initial and final tests in the skill element of Reading Achievement. All five groups demonstrated significant gains
in this skill. Group III, the Motor Ability Group, exhibited  
the highest t ratio, 7.14, which is significant at the one per 
cent level of confidence. Two other groups which demonstrated 
significance at the .01 level were Group IV (Reading) and  
Group V (Reading and Perception), with t ratios of 4.70 and  
5.40 respectively.

TABLE I

COMPARISON OF RESULTS BETWEEN INITIAL AND FINAL MEANS  
IN THE ELEMENT OF READING ACHIEVEMENT

<table>
<thead>
<tr>
<th>GROUP</th>
<th>M₁</th>
<th>SD₁</th>
<th>M₂</th>
<th>SD₂</th>
<th>M₁ - M₂</th>
<th>df</th>
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<td>3.28</td>
<td>.316</td>
<td>+ .88</td>
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<tr>
<td>III</td>
<td>2.38</td>
<td>.300</td>
<td>3.23</td>
<td>.196</td>
<td>+ .85</td>
<td>5</td>
<td>7.14**</td>
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<tr>
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<td>2.10</td>
<td>.265</td>
<td>2.98</td>
<td>.469</td>
<td>+ .88</td>
<td>5</td>
<td>4.7 **</td>
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<tr>
<td>V</td>
<td>2.38</td>
<td>.200</td>
<td>3.30</td>
<td>.728</td>
<td>+ .92</td>
<td>3</td>
<td>5.4 **</td>
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*Significant at the five per cent level of confidence.
**Significant at the one per cent level of confidence.

Table II summarizes the differences in the mean  
performances of each of the five groups in the initial and  
final tests in the skill element of Perceptual Performance.  
Group III (Motor Ability) again demonstrated the highest t  
ratio of 4.00, significant at the one per cent level of
confidence. Group IV (Reading) and Group V (Reading and Perception) had \( t \) values of 2.35 and 2.90 respectively, both significant at the five per cent level. The lowest ratio was demonstrated by Group I (Control), with a \( t \) ratio of 1.70, which was not significant.

TABLE II

COMPARISON OF RESULTS BETWEEN INITIAL AND FINAL MEANS
IN THE ELEMENT OF PERCEPTUAL PERFORMANCE

<table>
<thead>
<tr>
<th>GROUP</th>
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<th>SD(_1)</th>
<th>( M_2 )</th>
<th>SD(_2)</th>
<th>( M_1 - M_2 )</th>
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*Significant at the five per cent level of confidence.

**Significant at the one per cent level of confidence.

Table III summarizes the differences in the mean performances of each of the five groups in the initial and final tests in the skill element of Motor Performance. Group III, the Motor Ability Group, showed the most significant gain, with a \( t \) ratio of 5.00, which was statistically significant at the one per cent level of confidence. Group II (Motor
Ability and Reading), Group IV (Reading), and Group V (Reading and Perception) all showed differences that were statistically significant at the five per cent level. Group I, the Control Group, with a t ratio of only 0.98, did not show a gain significant at the .05 level of confidence in this skill.

TABLE III

COMPARISON OF RESULTS BETWEEN INITIAL AND FINAL MEANS IN THE ELEMENT OF MOTOR PERFORMANCE

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<tr>
<th>GROUP</th>
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<td>4.58</td>
<td>+ 8.2</td>
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<td>95.2</td>
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<td>+ 9.1</td>
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<td>+ 5.5</td>
<td>3</td>
<td>2.8*</td>
</tr>
</tbody>
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*Significant at the five per cent level of confidence.
**Significant at the one per cent level of confidence.
CHAPTER VII

DISCUSSION

The results indicate an improvement in Reading Ability in the five experimental groups. The Motor Ability Group, Group III, showed the greatest gain, at the highly significant one per cent level of confidence. It is especially interesting to note that the two groups which received special training in reading, Group II (Reading and Motor Ability) and Group IV (Reading), exhibited less improvement in Reading than Group III (Motor Ability).

In the element of Perception, Group III (Motor Ability) made a statistically significant gain at the one per cent level of confidence, while Group IV (Reading) and Group V (Reading and Perception) showed significant gains at the five per cent level.

In the element of Motor Performance, the Motor Ability Group (Group III), as expected, demonstrated the most significant gain, with a t ratio of 5.00, statistically significant at the one per cent level of confidence. Group II (Motor Ability and Reading), Group IV (Reading), and Group V (Reading and Perception) showed gains that were significant at the five per cent level of confidence. The gain made by Group I, the Control Group, showed no significance at the five per cent level of confidence.
It was shown that the Motor Ability Group, which did not have any special reading practice, improved in reading ability as much as the Control Group and Special Reading Group. In fact, the Motor Ability Group demonstrated a t ratio greater than all of the other groups in the Reading Achievement test.

The case studies made of the six individual members of Group III (Motor Ability) revealed the following points of interest:

After thirteen weeks of special training in motor skills,

1. All subjects showed an improvement in the skill element of Motor Ability Performance; the improvement in Motor Quotients ranged from +5 points to +14 points.

2. All subjects demonstrated improvement in the skill element of Perceptual Performance; gains in Perceptual Quotients ranged from +5 points to +14 points.

3. Every subject in the Motor Ability Group showed an improvement in the skill element of Reading Ability. The increases in Average Reading scores ranged from +0.3 to +1.2. In fact, all but one of the case study subjects demonstrated an Average Reading score of 3.0 or higher on
the final Metropolitan Reading Achievement Test. 
At the beginning of the study, as a result of their low performance on the initial Reading Achievement Test, all six subjects had been classed in the poor reader category (average reading rating below 3.0).

In addition, the comments of both the homeroom teachers and the investigator, based on subjective observations, indicate that there was decided improvement in attitude and behaviour in each of the case study subjects.
CHAPTER VIII

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to investigate the effects of special training in motor ability skills on the reading ability of grade two pupils who are classed as poor readers.

Thirty subjects, all grade two pupils at the McBride School in Vancouver, British Columbia, were selected to participate in the study. Each subject was classed as a retarded reader on the basis of their achievement on a standardized reading test for the grade two level.

The pre-training and post-training tests were standardized for all subjects. All thirty of the original subjects were scored on their performances in the Metropolitan Achievement Reading Test, the Otis Mental Ability Test, the Frostig Developmental Test of Visual Perception, and the Carpenter General Motor Capacity Test. The thirty subjects were then randomly assigned to five Sub-Groups for purposes of the Special Training Program. Group I was the Control Group. Group II received extra training in motor skills and reading. Group III received extra instruction in motor skills only. This Group was also selected for Case Study purposes. Group IV
received special instruction in reading only. Group V received extra training in reading and visual perception.

There were originally six subjects in each of the five sub-groups. Sometime during the training period, five of the subjects dropped out of school for various reasons, leaving four subjects in Group I, five in Group II, six in Group III, six in Group IV, and four in Group V.

Group III received approximately fifty minutes of daily instruction in motor ability skills for a total of sixty-five days. All the special training in motor skills took place in the special programs classroom at the McBride School.

At the conclusion of the special training period, the twenty-five remaining subjects were again tested in general motor capacity, perceptual ability, and reading competence.

Scores on the initial and final tests in motor capacity, perception, and reading were subjected to statistical analysis and the differences between the mean improvements of the groups were discussed.

Conclusions

The results of the study support the hypothesis that children who are classified as poor readers will, by taking part in a special motor skills training program, show significant improvement in reading ability. This finding is,
however, subject to a limited interpretation, since the subjects in all five groups showed similar improvements in reading skills as measured by the Metropolitan Achievement Test.

The failure of the special motor ability group to show clear-cut differences in improvement in reading ability from the control and other groups suggests possible limitations in the study:

1. Reliability of the Reading Achievement Test for children of this age level;

2. Problem of bias in groups, despite randomized selection, since groups in the study are very small;

3. Sufficient allowance for "time lag" effect, i.e., whether or not real differences between groups will be apparent after only a six-month period between tests;

4. Possible effect of extraneous influences, such as private reading, tutoring, home environment, special motivation, and the like.

However, this is not to deny the possibility that special motor ability training programs of relatively short duration may improve the reading ability of children as much as any other method.
The results showed a definite improvement in motor ability and visual perception, especially in those subjects who received special training in motor ability skills. The apparent improvement in the behavior and attitude of subjects in this Motor Ability Group would seem to be a very important benefit to the child who participates in special motor ability training programs. It seems that such programs can contribute to the improvement of the capacity of children to learn and benefit from schooling.
BIBLIOGRAPHY
BIBLIOGRAPHY

BOOKS


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APPENDIX A

STATISTICAL TREATMENT

The raw scores obtained from the initial and final test results of the Carpenter General Motor Capacity Test, the Frostig Developmental Test of Visual Perception, and the Metropolitan Achievement Reading Test were analyzed statistically in the following manner:

Study Design

I The Control Group
II The Motor Ability and Reading Group
III The Motor Ability Group
IV The Reading Group
V The Reading and Perceptual Group

Tests of the Reading Achievement in Grade Two Pupils

Test 1 Metropolitan Achievement Test
Test 2 Metropolitan Achievement Test

Tests of the Motor Achievement in Grade Two Pupils

Test 1 The Carpenter General Motor Capacity Test
Test 2 The Carpenter General Motor Capacity Test

Tests of the Perceptual Achievement in Grade Two Pupils

Test 1 Frostig Developmental Test of Visual Perception
Test 2 Frostig Developmental Test of Visual Perception
Plan

The Control Group

Initial Tests
No extra instruction in motor, reading and perceptual training

Final Tests

The Motor Ability and Reading Group

Initial Tests
Thirteen weeks of instruction in motor training and remedial reading

Twenty-five minutes of Motor Training
Twenty-five minutes of Remedial reading daily for the thirteen weeks

Final Tests

The Motor Group

Initial Tests
Thirteen weeks of extra instruction in motor training

Fifty minutes daily for thirteen weeks

Final Tests

The Reading Group

Initial Tests
Thirteen weeks of extra instruction in remedial reading

Fifty minutes daily for thirteen weeks

Final Tests

The Reading and Perceptual Group

Initial Tests
Thirteen weeks of extra instruction in remedial reading and perceptual training

Twenty-five minutes of remedial reading daily and Twenty-five minutes of perceptual training daily for the thirteen weeks

Final Tests
Procedure and Formulae

Determination of the significance of the difference between the correlated means of the initial and final test results in the three skill elements for each of the experimental groups was calculated according to the following formulae:

1. Number of subjects: \((N)\)
2. Mean Score: \(M = \frac{\sum X}{N}\)
3. Standard Deviation: \(\sigma = \sqrt{\frac{\sum X^2}{N} - M^2}\)
4. Standard Error of the Mean: \(\sigma_M = \frac{\sigma}{\sqrt{N - 1}}\)
5. Difference between the Means: \((M_1 - M_2)\)
6. Correlation between Initial and Final Test Results:
   \[ r_{1,2} = \frac{N \sum XY - \sum X \sum Y}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}} \]
7. Standard Error of the Difference between Correlated Means:
   \[ S.E.D = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2 - 2r_{1,2} \sigma_{M_1} \sigma_{M_2}} \]
8. Calculation to the 't' Ratio: \(t = \frac{M_1 - M_2}{S.E.D}\)

The level of confidence was required to reach 0.05 to be acceptable. The table of \(t\) at both the 0.05 and 0.01 levels of confidence for a one-tailed test with five degrees of freedom (\(N-1\)) is shown to be 2.02 and 3.36 respectively; for four degrees of freedom (\(N-1\)) as 2.13 and 3.75 respectively;
for three degrees of freedom (N-1) as 2.35 and 4.54 respectively (1).

REFERENCES

APPENDIX B

KEPHART PERCEPTUAL-MOTOR PERFORMANCE TASKS (1)

Purpose of this Section

This section is devoted to a description of a series of performances designed to permit the observation of a child's perceptual-motor behaviour. These are motor tasks designed by Kephart to reveal the perceptual-motor ability of the child at each developmental stage. The examiner observes the performance of the child and attends to certain evidences in his behaviour which indicate his perceptual-motor status.

These tasks are designed to permit observation of the child in a relatively short period of time and without the use of complicated devices and apparatus. A close observation of the child's performance will permit the teacher to identify his level of development and to make a preliminary selection of training methods which will aid him.

It is felt that the teacher will find this series of observations helpful in evaluating children's ability and performance. It provides a somewhat new way of looking at the child and can serve as a guide to a re-evaluation. The observations presented here are somewhat different from the customary evaluations through readiness and achievement tests. The present observations can therefore provide valuable
additional information as a guide for dealing with the problems of the child.

The tasks have been designed for and clinically investigated with children six to nine years of age. Although they will be found useful with retarded children at older age levels, some of the tasks will be found too simple for older groups. By the same token, some will be found too difficult for children below age six. Since the identification of the readiness problems in which we are interested is most critical when the child begins school, tasks at the six- to nine-year level have been selected.

WALKING BOARD (OR BEAM)

The walking board is a modification of the childhood game of walking a rail fence or walking along the rails of a railroad track. Techniques similar to this have been used extensively in kindergarten and elementary school grades. Commercial models of a walking beam will be found in many school systems.

The primary function to be observed with the walking board is that of balance. We can also observe postural flexibility 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 itself and is approached more specifically when we ask the child to walk the board in the sidewise directions. When we introduce the backward direction, we require difficult spatial orientation and spatial projections.

**Forward**

The walking beam is a section of two-by-four measuring eight to twelve feet long and laid along the floor with its wider edge down. The child walks on the two-by-four as he would walk on a fence rail.

Start the child at one end of the beam. Ask him to walk to the other end. Give no further instructions. Observe the manner in which he is able to balance himself on the beam. Is he able to catch his balance and correct himself when he is in danger of falling off?

Some children will be found who attempt to solve the problem by avoiding the requirement for balance. Thus, they will run across the beam or take very long strides in an effort to reduce the number of times that they have to come to balance. In these cases, instruct the child that he is to walk slowly and use normal strides. Other children will attempt to place their feet crosswise on the beam and thus increase the extent of the surface in order to decrease the demand for balance. Such children should be instructed to
place their feet straight along the board. After the examiner has observed the child's initial attempt, he may demonstrate the proper method.

**Evaluation.** Inadequate performance in this task is indicated by failure to maintain balance. The child who steps off the board more than once or who pauses frequently when he is out of balance and has trouble regaining his balance is showing difficulty. His performance would indicate that he could profit from training procedures designed to aid general postural adjustment, such as the walking board training and the balance board and trampoline training.

Watch the manner in which the child maintains his balance. Does he use one side of the body much more consistently than the other? For example, does he use one arm almost exclusively as a counter-balance? If so, walking board or balance board training can be modified to help him learn to use both sides together. Ask him to walk the walking board or balance on the balance board while holding a broomstick or long pole in the manner in which a tight-rope walker holds a balancing pole. Set his hands wide apart on the pole. When he makes a balancing movement with one side, a compensatory movement of the opposite side is forced upon him by the pole. In this manner, he can be given practice in bilateral activity.
On the other hand, the child may appear too bilateral on the walking board. Does he use his two arms symmetrically during too much of his performance? Does he appear to have trouble when balance requires a response on one side only? If so, the walking board and balance board training can be modified again. In this case, give the child two objects to carry in his hands as he balances. One of these objects should be markedly heavier than the other. With the weights in his hands, bilaterally symmetrical responses become impossible. The same extent of movement on both sides requires more effort on one side than on the other. In like manner, the counter-balancing effect of a movement on one side is greater than that of a movement of the same extent on the other side. Similar training can be provided for the feet and legs by tying sandbags onto the child's ankles.

**Backward**

Start the child at one end of the beam with his back toward it and the board extending out behind him. Ask him to step up on the beam and walk backward to the other end. The same avoidance behaviours discussed above may be encountered here and are dealt with in the same manner. In addition, in the backward task, the child may twist his body so that he is able to look behind him to see where he is going. If this occurs, ask the child if he can walk the beam backwards
without looking. Stand in front of him and ask him to keep looking at you while he walks the beam.

**Evaluation.** Inadequate performance is indicated by frequent loss of balance and by stepping off the board more than twice. If the child cannot perform without watching his feet or hesitates excessively in stepping back, he may be having trouble with the backward direction. Such children can be helped by training in posture and balance (walking board, balance board, trampoline).

**Sidewise**

Start the child at one end of the beam facing at right angles to it so that the beam extends to his right. Ask him to step up on the beam and walk sidewise to the other end. Observe whether the child is able to shift his weight from one foot to the other. He should move his right foot to the right and bring his left foot up to it. Notice any hesitation or confusion when movement must change from one foot to the other. Some children will try to cross one leg over the other. After the examiner has observed this difficulty, he may demonstrate the correct method. If the child takes unusually large strides, ask him to step normally. When he has progressed to the end of the beam, ask him to walk back sidewise, moving to his left. Some children will be found who can walk the board in one direction but not in the other. It
is felt that these children are accustomed to avoiding the laterality and directionality problem by using only one side as a leading side. When asked to lead with the opposite side, they cannot perform. In walking the beam from right to left, the child must lead with his left foot. In walking from left to right, he must lead with his right foot.

**Evaluation.** This activity is designed to provide additional information regarding the use of the two sides of the body. It is particularly useful in identifying the child who is too one-sided. Watch for the child who has particular difficulty in one direction (stepping off the board more than twice) and for the child who obviously performs more easily in one direction than in the other. Such children are probably having trouble with laterality and are solving the problem by using excessive dominance of one side.

Modifications of the balance board and walking board training described above will be found useful. One of the best devices for such children is the trampoline since it emphasizes the importance of symmetrical activities. Angels-in-the-Snow may be needed to help the child identify and control the parts of his body on the non-dominant side.

**JUMPING**

We can gain further information concerning the child's
ability to maintain balance and posture if we ask him to perform against the pull of gravity. The easiest method of controlling such activities is through the use to hopping, skipping, and jumping performances. The present techniques are designed to indicate how well the child can maintain control of his body when he is asked to behave symmetrically, to behave with each side alone, and to behave alternately between sides. Many of the activities suggested here have been included in the curriculum of physical education for many years. Through careful observation, they can also be used to give us insight into the level upon which the child is behaving.

The series is designed to present first bilateral activities (item A), then unilateral activities (items B and C), the alternating activities - regular alternation (items D, E, and F) and irregular alternation (items G and H). 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.

On alternating activities, the examiner should observe very carefully to see whether the alternation is a true flow of activity from one side to the other or whether it is two separate activities. Skipping is a good example. Skipping has been used extensively in classrooms and many children have been listed as able to skip when the activity did not flow
smoothly from one side to the other. Such children, in effect, hop once on the right foot, stop, and then hop once on the left foot. They have treated each side separately and have set up a separate task on each side of the body. The performance which we would like to see is one in which the movement flows smoothly and uninterruptedly from one side to the other and back again. The latter type of performance is indicative of much better laterality and body image than is the former.

A. Both Feet

Stand the child at the side of the room where he has a clear space measuring the length of the room in front of him. Ask him to put both feet together and to jump forward one step. The child must hold his feet together while he jumps and must not step forward as in walking. Observe whether he can use both sides of his body in this parallel fashion.

B. Right Foot

Ask the child to stand on his right foot with his left off the floor. Now ask him to jump forward one step using his right foot only. Observe whether he can shift his posture in order to operate with one side of his body only. During the task, the left foot must not touch the floor.
C. Left Foot

Ask the child to stand on his left foot and jump one step forward with his left foot only. Some children will be found who can perform this task with one foot but not with the other. Observe the same behaviour as in the right-foot task.

D. Skip

Ask the child to skip across the room using the feet alternately. Observe whether this is good free movement. Does the child alternate sides with ease or does he, in effect, have to stop after each step and determine which side he must use next?

E. Hop 1/1

Ask the child to stand with his feet together. Now ask him to hop on the right foot, lifting the left. Next ask him to hop on the left foot, lifting the right. Now ask him to alternate, hopping first on the right and then on the left. The child's body should remain in one spot during the hopping performance. Observe whether he is able to shift easily from one side to the other and whether his behaviour is smooth and rhythmical or stiff and jerky. The latter type of behaviour is evidence that he cannot readily shift from one postural orientation to another in a lateral direction.
F. Hop 2/2

This task is the same as the foregoing except that the child hops twice on the right foot, twice on the left, etc. This task is more difficult since the rhythm patterns and alternations are not as regular. Observe the performance for rhythm and smoothness.

G. Hop 2/1

Ask the child to hop twice on the right foot, once on the left, twice on the right, etc. This task is still more difficult since the alternation patterns are more complicated. Observe the performance for rhythm and smoothness.

H. Hop 1/2

Ask the child to hop once on the right foot, twice on the left, etc. This task is the same as the preceding except that the sides are reversed.

Evaluation

Items A through E are related to the child's ability to control his gross musculature and to alternate activities across the center of gravity of his body. Failure on any of these items would suggest that the child could profit from training techniques concerned with gross body control, such as angels-in-the-snow, trampoline exercises, etc.

Items F through H introduce in addition to body
control a factor of rhythm. The child who fails only on the latter items 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.

IDENTIFICATION OF BODY PARTS

Ask the child to stand facing you at a distance of about ten feet. Say to the child:

1. Touch your shoulders.
2. Touch your hips.
3. Touch your head.
4. Touch your ankles.
5. Touch your ears.
6. Touch your feet.
7. Touch your eyes.
8. Touch your elbows.
9. Touch your mouth.

Observe whether there is hesitancy in any response or whether the child is decisive in obeying each command. Observe whether in the paired parts he touches both members of the pair. In the case of the command "touch your elbows," it is necessary for him to cross his arms over each other. A slight hesitancy here is permissible since many children are
startled at the change in posture required. When he has started a movement toward a part, can he move accurately to that part or does he start in the general direction and then "feel around" for the final target?

**Evaluation**

This performance is related to the problem of body image. There are two general areas of knowledge involved. The first is awareness of the existence of the parts and their names. Recognition and naming of parts of the body is routinely taught in nursery and kindergarten programs and these methods are adequate for this purpose.

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.

**IMITATION OF MOVEMENTS**

Ask the child to stand facing you at about eight to ten feet and far enough away from walls and other obstructions
FIGURE 3

Positions of the arms for seventeen items of the Imitation of Movements task. To move from each position to the next requires one of the following types of movement: U = unilateral movement, B = bilateral movement, C = crosslateral movement.
that when he extends his arms he will not strike some object. With his hands loose at his sides, ask him to do whatever you do. Beginning with pattern No. 1, move through each of the patterns in Figure 3 in order. Observe the child's movements in going from one pattern to the next. These patterns are so designed that unilateral, bilateral, and crosslateral movements are required.

Observe the following:

(1) It is desirable that the child reverse the laterality of the examiner's movements. That is to say, when you move your right hand, he should move his right hand. A great many children will be found who parallel the movement which they see. Thus, they will move to their left when you move your right arm. Do not instruct the child regarding this translation. If he does not spontaneously reverse the pattern, allow him to go on paralleling it. Most children will continue to parallel the examiner's movement. This performance is acceptable as long as it is consistent. However, the child who sometimes parallels and sometimes reverses is indicating trouble.

(2) Movements should be made promptly and with definiteness. Observe any hesitation or lack of certainty in the child's response. Look especially for abortive movements either in the arm which should not move or toward a different direction in the arm or arms which should move.
(3) The child may fail to reproduce the movement pattern on the first attempt. Some children will become confused. They will move both arms when only one is required to move. If the movement is completed before the child appears to recognize that he has made a mistake, pay special attention to this fact. Sometimes a child may take the wrong position and not recognize this fact until it is called to his attention. In this case, point out his error and be sure that he achieves the correct position before proceeding, since the next pattern of movement will be altered if he does not start from the correct position. Observe the child who reverses his patterning. He may reverse the pattern for a time, then parallel it for a time. This child is showing confusion in laterality and in body image.

Evaluation

This activity is related to the child's ability to control his upper limbs independently and in combination. It also requires the translation of a visual pattern into a motor pattern which will reproduce it. Difficulty is shown whenever the child displays hesitancy, lack of certainty, or error in executing the patterns.

The child who displays difficulty can be aided by training procedures designed to help him with identification and control of individual parts. The angels-in-the-snow and
rhythm techniques will be found useful. To aid with the translation of the visual pattern into a motor pattern (and the reverse), this same examination procedure can be used as a training device. Repeat the movements a number of times and ask the child to attempt to reproduce them. Pay particular attention to those patterns with which he shows particular problems.

ANGELS-IN-THE-SNOW

Ask the child to lie on his back on the floor with his arms at his side and his feet together. Ask him to move his arms up over his head. Be sure he moves them along the floor. Ask him to feel the floor with his wrists as his arms move. Be sure he gets his arms completely above his head until his two hands touch.

Next ask him to move his feet apart. Be sure he moves them wide apart and keeps his heels on the floor during the movement. The examiner may demonstrate the movement of arms and legs. These preliminary exercises are used to acquaint the child with the technique. When he has learned what you want him to do, say:

1. Move just this arm (pointing to the left arm). Now back.
2. Move just this arm (pointing to the right arm). Now back.
3. Move just this leg (pointing to right leg). Now back.
4. Move just this leg (pointing to left leg). Now back.
7. Move this arm and this leg (pointing to left arm and left leg). Now back.
8. Move this arm and this leg (pointing to right arm and right leg). Now back.
9. Move this arm and this leg (pointing to right arm and left leg). Now back.
10. Move this arm and this leg (pointing to left arm and right leg). Now back.

Do not give the child any clue to the limb which you ask him to move other than pointing to it. Some children will be found who are unable to identify the limb by this visual clue alone. Note that he was unable to identify visually.

Observe whether or not the child's movements are smooth and decisive. Note any jerky movements and any hesitation in beginning a movement. The latter probably indicates a difficulty in initiating a movement in a prescribed limb. Note whether all movements reach their maximum extension. Many times the child will restrict the movement of one or more limbs when he is required to control the entire movement sequence. Frequently the movements will be adequate when they are bilaterally symmetrical (as in the
pre-test exercises) but will become restricted when unilateral or crosslateral patterns are called for.

Observe whether the child starts his movement promptly and whether his first movement is a definite part of the prescribed pattern. Frequently a child will identify the innervational pattern necessary to begin the movement by abortive trial movements. Such lack of complete knowledge will often be revealed in false starts, moving the limb up and down on the floor a fraction of an inch to identify it, asking for repetition of instructions, looking from one limb to another before beginning, and so forth.

Observe carefully whether there is overflow into other limbs whose movements is not called for. Thus, when the child is asked to move the left arm and right leg, is there also movement in the right arm or left leg? Often the prescribed movement will be translated into bilaterally symmetrical patterns and both arms or both legs will move.

Evaluation

Difficulty with this task indicates that the child is experiencing problems in controlling the parts of his body individually or in prescribed combinations. Inadequate performance is shown by: (1) marked hesitancy in beginning the movements; (2) restriction of the extent of movement in any of the patterns; (3) overflow of movements to limbs not
required in the pattern; (4) inability to initiate movement or identify a limb on the basis of visual clues alone (developing tactual information by pressing against the floor or kinesthetic information by abortive movements); or (5) inability to carry out any of the patterns.

For the child who has difficulty with this task, the task can be used as a training activity. In cases of severe failure, simpler techniques such as the walking board, imitation of movement, stunts, etc., may need to be used first to develop more adequate control of limbs and laterality concepts before the child can perform successfully in the present activity. In cases of paralysis or spastic conditions, medical assistance will be required and special attention may need to be given to specific limbs.

EXERCISES, STUNTS, AND GAMES

USED IN THE MOTOR ABILITY SKILLS TRAINING PROGRAM

I BODY EXERCISES

1. Crawling
2. Crawling with "rider"
3. Duck Walk
4. Walking while holding calves
5. Lying down and rolling over
6. Walking sideways with arms folded in front, with crossing
legs and without crossing legs. Cross legs in front, in back, and then one in front and one in back. Increase tempo during exercise. Don't twist torso.

7. Walking with swinging the leg forward and backward.

8. Sitting to standing. Sit on floor with knees bent, feet in front, get up and sit down again. Same exercise, but begin with sitting with crossed legs.

9. Kneel, get up, and go back to kneeling position again.

10. Lie on floor on back and get up by rolling forward.

11. Lie on floor on stomach and get up by putting hands on floor and jumping up.

12. Walk erect, walk in duck walk, then back to walking erect.

13. Crouch, jump up, down to crouch again.

14. Knee bend

15. All possible obstacle runs

16. All climbing equipment

17. "Angels-in-the-Snow"

18. Circle arms parallel to body, backwards and forwards

19. Arms outstretched to the side, begin with small circles, let them get bigger until they are as large as possible, then let them get smaller again until arms stop. Do backwards and forwards.

20. Arms stretched out in front, begin with small circles, let them get bigger until they are as large as possible, then let them get smaller again until arms stop. Let
both arms go in same direction to right, then to left, then move both arms in opposite directions.

21. Arms outstretched, bend elbows to place hands on waist, back again.

22. Move head in a circle, right and left.

23. Move head from right to left and backwards several times.

The following exercises should be done in various positions: standing with legs apart, standing with legs together, sitting, kneeling, preferably on floor with crossed legs.

24. Arms in front, parallel. Swing to right and left. Turn torso as far as possible.

25. Arms overhead. Bend torso as far as possible to right and left.

26. Arms overhead. Swing arms and bend torso toward the front. If possible, do this also sitting on floor with legs outstretched parallel and also outstretched in front (V shape).

27. Swing legs, standing, while holding on.

28. Circle legs while standing, holding on.

29. Move legs up and down while lying on the floor on the back.

30. Circle legs in opposite directions while lying on floor.

31. Sit on chair, stretch legs out in front horizontally, put legs on floor, then do the same but try to touch legs
with outstretched arms, bending forward.

32. Stand with feet together and move heels from floor and back to floor, keeping legs straight, until you begin to gain momentum and toes leave the floor. While jumping, keep toes straight down. Try to jump lightly.

33. Run with wide steps. As you are gaining momentum, make wide jumps. Jump as wide and high as possible, bending torso back while in the air, and stretching the foot while you jump down.

34. Jumping, feet once apart, and once together.

35. Same as in (34), but slowly turning around on one's axis.

II BALANCE EXERCISES

(1) The Walking Board:
(a) walking forward
(b) walking backward
(c) walking sidewise
(d) walk and turn around
(e) bouncing
(f) bean bag into something
(g) catching and throwing ball, bean bag
(h) balancing bean bag on head

(2) The Balance Board:
(a) simple balancing
(b) rocking
(c) ball bounce and catch
(d) bean bag or ring toss
(e) simple calesthenics
(f) identification movements
(g) balancing bean bag on head while doing any of above
(h) log rolling on the spools
(i) eye exercises
- watching a target
- crisscross
- different labels

(j) use of poles - can be weighted

(3) The Trampoline: (4) Other Balance Stunts:

(a) bouncing (both feet)  (a) Skater's stance
(b) bouncing (one foot)  (b) Squat balance
(c) controlled bouncing in  (c) the Teapot
    one spot
(d) turn in air (90°)  
(e) turn in air (180°)  
(f) seat drop  
(g) knee drop  
(h) back drop  
(i) front drop  
(j) combinations  

III GAMES

1. Play pulling. One child is a horse, another the cart.
The "cart" holds the "horse" somewhat back by leaning
backwards.

2. Children pretend they are pulling a heavy load, moving forward by themselves. They may also move in groups.

3. Children pretend they are pushing something heavy while walking forward.

4. Children pretend they are pushing something back with their backs, moving backwards.

5. Children walk sideways with a pushing or pulling motion, bending their bodies as if they were pulling a rope.

6. Children begin with one of the movements as before, but then pretend that the load gets light and they walk happily around.

7. The movements 1 - 6 are done by various groups simultaneously, each group reacting to the other one.

8. The children play "the storm". First they run with arms outstretched and are the wind. Then they tiptoe lightly running fast: the rain. The rain gets heavier and they jump, being thunder and lightning. Then there is again light rain until they crouch or lie down. The storm is over.

9. The children play the bird tree, a bird, an airplane, three playing bunnies, fighting children, etc.

10. Ball games help with eye-hand coordination: throwing a ball, bouncing a ball, Knocking cartons down with a ball, throwing a ball into a basket.
11. Hopscotch, ring toss.
12. Circle games: tag, drop the bean bag, Red Rover, Don't Cross the Line, Cross the Line to Safety Goals, Squirrel in the Cage.
14. Hoop games: hoops or inner tubes.
15. Singing games: Ring Around the Rosie, Did you Ever See a Lassie?, The Farmer in the Dell, London Bridge, Looby Loo, This is the Way we Wash our Clothes.
16. Games involving much running, hopping and skipping should be played daily.
17. Rabbit hop.
18. Crab Walk.
20. Elephant walk (pairs).
21. Tunnel ball.
22. Leap frog.
23. Hot potato.
25. Red Light, Green Light.
26. Rope Skipping.
27. Hula hoop contest.
28. Follow-the-leader.
SAMPLE OF A LESSON PLAN USED IN THE
MOTOR ABILITY SKILLS TRAINING PROGRAM

Motor Skills Training Program

WEEK OF: January 16 - 20

DATE: Thursday, January 19, 1967

INSTRUCTOR: E.A. Duggan

GROUP: Group III Subjects

Body Exercises (5 minutes)
1. Sitting to standing.
2. Crouch, jump up, down.
3. Obstacle run.

Trampoline and Balance Exercises (15 minutes)
1. Forward, sidewise, backward on walking board (with bean bags balanced on heads).
2. Skater's stance and squat balance.
3. Trampoline: bounce and half-turn, bounce on one foot, knee drop.

Games (5 minutes)
1. Throw-Catch game with rubber balls.
REFERENCES

APPENDIX C

RAW SCORES

GENERAL MOTOR CAPACITY TEST SCORES FOR GROUP III SUBJECTS

SUBJECT: Donn A.

SCORES MADE ON INITIAL TEST:

<table>
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<tr>
<th>AGE</th>
<th>HEIGHT</th>
<th>WEIGHT</th>
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<th>CONVERTED SCORE</th>
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SUBJECT: Phillip E.

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General Motor Capacity Score (GMCS): 114.56

Norm for General Motor Capacity: 121.68

Motor Quotient: 94.15

SCORES MADE ON FINAL TEST:

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General Motor Capacity Score (GMCS): 144.63

Norm for General Motor Capacity: 134.05

Motor Quotient: 108.00
SUBJECT: Cindy F.

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General Motor Capacity Score (GMCS): 60.40
Norm for General Motor Capacity: 59.57
Motor Quotient: 101.39

SCORES MADE ON FINAL TEST:

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General Motor Capacity Score (GMCS): 64.25
Norm for General Motor Capacity: 60.20
Motor Quotient: 106.00
SUBJECT: Grant H.

SCORES MADE ON INITIAL TEST:

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General Motor Capacity Score (GMCS): 146.19
Norm for General Motor Capacity: 161.01
Motor Quotient: 90.80

SCORES MADE ON FINAL TEST:

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General Motor Capacity Score (GMCS): 167.91
Norm for General Motor Capacity: 164.46
Motor Quotient: 102.00
SUBJECT:  Mark M.

SCORES MADE ON INITIAL TEST:

AGE:  7-0    HEIGHT:  49"    WEIGHT:  58 lbs.

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General Motor Capacity Score (GMCS): 139.47

Norm for General Motor Capacity: 150.27

Motor Quotient: 92.81

SCORES MADE ON FINAL TEST:


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General Motor Capacity Score (GMCS): 159.98

Norm for General Motor Capacity: 158.30

Motor Quotient: 101.00
SUBJECT: Samuel W.

SCORES MADE ON INITIAL TEST:

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General Motor Capacity Score (GMCS): **139.36**
Norm for General Motor Capacity: **143.98**
Motor Quotient: **96.79**

SCORES MADE ON FINAL TEST:

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General Motor Capacity Score (GMCS): **156.36**
Norm for General Motor Capacity: **153.30**
Motor Quotient: **102.00**
FROSTIG VISUAL PERCEPTION TEST SCORES
FOR GROUP III SUBJECTS

Key to Abbreviations:

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<th>Abbreviation</th>
<th>Description</th>
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<td>E.M.</td>
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<tr>
<td>F.G.</td>
<td>Figure-Ground</td>
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<tr>
<td>F.C.</td>
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<tr>
<td>P.S.</td>
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<td>S.R.</td>
<td>Spatial Relations</td>
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<td>P.Q.</td>
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