USEFULNESS OF THE MARIANNE FROSTIG DEVELOPMENTAL TEST OF VISUAL PERCEPTION AND THE FROSTIG PROGRAM FOR THE DEVELOPMENT OF VISUAL PERCEPTION AT THE FIRST GRADE LEVEL

by

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ABSTRACT

The purpose of this investigation was to determine whether the Marianne Frostig Program for the Development of Visual Perception is successful in terms of increased reading readiness and visual perceptual abilities, when used in the regular classroom. Thirty-two first grade pupils were selected as subjects on the basis of below-normal scores on the Marianne Frostig Developmental Test of Visual Perception and the Clymer-Barrett Prereading Battery, Form A. Both the experimental and control groups were taught by the experimenter. Three times a week for six weeks the experimental group received fifteen to twenty minutes of physical, three-dimensional and two-dimensional exercises according to the Frostig Program for the Development of Visual Perception. The control group received instruction as prescribed by the course of study. No significant improvement of the experimental group over the control group was found at the .05 level of significance. It was concluded that much further investigation into the suitability of this program for a regular classroom should be done regarding the optimal age level and class size; training, personalities and attitudes of the teachers involved; and the optimal duration and concentration of the program.

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CHAPTER I

THE PROBLEM

That it is important for a child to experience success in school is a fact that no psychologist, physician, parent nor educator will dispute. That many children do not experience this success because of various physical, intellectual and emotional handicaps is also an accepted fact. In recent years, investigators have begun to focus their attention on disturbances of perceptual functions which might cause failure to achieve normally in school. The market is being flooded by tests purporting to measure various psycholinguistic and perceptual functions. Many of these tests, because of the pressure exerted on their authors, have been released prematurely. Although they describe elaborate standardization techniques and clinical studies, authors seldom cite studies which demonstrate the usefulness of the test nor the subsequent remedial program in the setting in which they are likely to be used most frequently.

One such test is the Marianne Frostig Developmental Test of Visual Perception which was designed to be a tool for assessing deficits in visual perception in children between the ages of four and eight years. The areas of visual perception which Frostig attempts to explore in five subtest areas are eye-motor coordination, figure-ground perception, form constancy, position in space, and perception of spatial relationships. Although these were never thought to be the only visual-perceptual abilities involved in the total process of visual perception, Frostig believed them to be important parts of the process and of particular relevance to school performance.[1] Frostig, Lefever and

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[1]Phyllis Maslow, Marianne Frostig, D.W. Lefever and J.R.B. Whittlesley, "The Marianne Frostig Developmental Test of Visual Perception, 1963 standardization," Perceptual and Motor Skills, 19:463-99, 1964, Monograph Supplement 2-V9.

Whittlesley developed their test on the assumption that "adequate visual perceptual skills are of crucial importance in learning to read and that visual perceptual abilities must be viewed as discrete entities which develop, in large measure, independently of one another."[2] Supported by Piaget's theory that perception is a major developmental task of the child between the ages of three and approximately seven and one-half years, Frostig also believed that visual perceptual skills are developmental in nature and appear to mature most rapidly between the ages of four and seven and that these skills can be taught in a structured program (referring to the Frostig Program for the Development of Visual Perception[4]), in the classroom.[5] To further support her assumptions, the Marianne Frostig School of Educational Therapy has carried out several studies both before and after releasing the test.

With respect to reliability, Frostig et al cite test-retest reliability coefficients from .29 to .74 for the scale scores of Kindergarten children and from .39 to .69 for first grade children, and split-half reliabilities ranging from .78 for children eight and nine years of age to .89 for children of five and six years of age. With respect to validity, the authors, by comparing the Frostig test with the Goodenough Draw-A-Man Test, have attempted to show that their test does not measure intelligence. The correlations obtained were from .318 to .460. Frostig et al conclude from the scores of seventy-one abnormal children on the Frostig test that "the abnormal degree of scatter in

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[2]James N. Jacobs, "An evaluation of the Frostig visual perceptual training program," Educational Leadership, 25 (January, 1968), p. 333.

[3]Paul Mussen, J.J. Conger and Jerome Kagan, Child Development and Personality, Second Edition (New York: Harper and Row, 1963), pp. 253-55.

[4]Marianne Frostig and David Horne, The Frostig Program for the Development of Visual Perception: Teacher's Guide (Chicago: Follett Publishing Company, 1964).

[5]James N. Jacobs, op. cit., p. 333.

their various subtests suggests that distinct functions of visual perception can be disturbed independently and to varying degrees."[6] The authors have not, however, attempted a factor-analytic study to support this observation. Predictive validity is tested in the University Elementary School Study where it was demonstrated that out of twenty-five children aged four and one-half to six and one-half years who were exposed to reading material but not required to read, eight children did not learn to read and were later found to have perceptual quotients of less than 90, thus displaying visual perceptual difficulties. Of those who had perceptual quotients of over 90, only one showed any reading difficulty. Research into other beginning reading situations in which children were required to read showed a correlation coefficient of from .4 to .5 between the visual perceptual test scores and reading scores. A pilot training study attempting to assess methods of alleviating the perceptual difficulties in a carefully controlled situation at the Frostig School showed that children with perceptual quotients of 90 or less did gain significantly more than those left in the regular school situation when retested on the Frostig Test. Of a clinical school sample of fifty-three children with IQ's of 76 or more who had severe learning disabilities, 55 per cent had scores falling below the 25th percentile on the Frostig Test. This observation was found to agree with a survey of perceptual scores on tests previously administered to these children.[7] The authors propose further investigation into the reliability and validity of their scale, but the results of this work are not yet available.

The ultimate proof of the efficacy of a diagnosis made on the basis of a test such as the Frostig Test must lie in the improvement in

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[6]Marianne Frostig, D.W. Lefever and J.R.B. Whittlesley, "A developmental test of visual perception for evaluating normal and neurologically handicapped children," Perceptual and Motor Skills, 12:392, 1961.

[7]Maslow, Frostig, Lefever and Whittlesley, op. cit., p. 248.

achievement effected through the remediation of those perceptual difficulties specified by the test. The authors of the Frostig Test and Program have through their pilot study shown that this is so in a clinical setting. However, one questions the credibility of the study where the achievement of children trained in a clinical setting (the Frostig School) with specially-trained teachers is compared with that of children left in a regular classroom setting.

The Frostig Test and Program are being used in many school districts in British Columbia.[8] Both, according to the author, are easily utilized in a regular classroom setting. At present, however, there is no statistical evidence to show that the Frostig Program prescribed on the basis of test performance has been effective in ameliorating perceptual difficulties and promoting normal achievement when carried out in the regular classroom.

Purpose of the Study

The purpose of this study is to further investigate the usefulness of the Marianne Frostig Developmental Test of Visual Perception and The Frostig Program for the Development of Visual Perception in the regular classroom setting with particular attention to the following questions:

1. Will children diagnosed as having perceptual disturbances according to the Frostig Test and trained according to the Frostig Program in a regular classroom setting show a greater improvement in perceptual skills than perceptually disturbed children receiving the regular first-grade language arts program?

2. Will these children trained on the Frostig Program also show a greater improvement in reading readiness as measured by the Clymer-Barrett Prereading Battery than those receiving the regular first-grade program?

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[8]Some districts include Richmond, Surrey, Vancouver, Coquitlam, West Vancouver, Prince George, Kamloops, Kimberley, Dawson Creek and Fort St. John.

Statement of the Hypotheses

1. Children with perceptual difficulties trained in the regular classroom on the Frostig Program will show significantly more improvement in those perceptual skills measured by the Frostig Test than those children with perceptual difficulties who have not been trained according to the Frostig Program.

2. Children with perceptual difficulties trained in the regular classroom on the Frostig Program will show significantly more improvement in reading readiness skills than children with perceptual difficulties who have not been given the program.

It is hoped that the findings of this study, be they positive or negative will prove to be useful to school districts who, while they cannot make special clinical provisions for their pupils exhibiting visual perceptual deficits, will be able to help classroom teachers to find methods most suitable to the remediation of the learning and adjustment difficulties these children will experience.

CHAPTER II

REVIEW OF THE LITERATURE

It has been said:

> Of the avenues by which the sense data, the raw material of perception, are received, the most important is perhaps that of vision. We probably depend upon our abilities in visual perception more than upon any other mode of perception to communicate with our environment. Our extreme reliance upon visual perception is implied by the common metaphors of vision used in our daily speech: we tend to say, "I'm looking forward to seeing you" rather than "I'm anticipating meeting you" or "let me see" when the more precise verb might be "consider." As these common usages imply, both direct experience and thought processes depend greatly upon adequate visual perception and this is nowhere more true than in relation to school learning.[9]

Visual perception can be simply defined as "...the individual's organization and initial interpretation or categorization of what he sees...."[10] That it is a necessary condition for reading is self-evident for it is the "interpretation or categorization" of letters on a page which we call reading--an indispensible skill to all areas of learning.

Most test batteries which are being developed to diagnose learning problems include at least one subtest or scale aimed at measuring visual perceptual abilities. The Illinois Test of Psycholinguistic Abilities,[11] for example, includes visual perception both at a representative level and at an automatic-sequential level.

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[9]Marianne Frostig, "Assessment of visual perception and its importance to education," The A.A.M.D. Education Reporter, 2 (April, 1962), p. 11.

[10]Mussen, Conger and Kagan, op. cit., p. 248.

[11]Samuel A. Kirk and James J. McCarthy, The Illinois Test of Psycholinguistic Abilities, (Chicago: University of Illinois Press, 1961).

an indication of the importance of visual perception to the major areas of psycholinguistic functioning. The Purdue Perceptual-Motor Survey[12] includes several subtests requiring visual perception: eye-hand co-ordination, temporal spatial translation and form perception, all of which Kephart[13] considers to be among the basic skills needed to perform basic tasks and must be learned before the child can progress to more complex experiences. Getman stresses the importance of total integration of visual processes for the successful adjustment of the individual in our society.[14] Similarly, remedial programs for these learning disorders stress the importance of integrating all perceptual functions, including the visual perceptual, into an efficient whole. In programs such as the ones proposed by Fernald[15] and Monroe,[16] development of the visual perceptual appears to be the ultimate goal. Both programs emphasize a multi-modal approach utilizing the auditory and kinesthetic channels as well as the visual and gradually narrowing it down to the visual channels only. Frostig observed:

> Disturbances in visual perception were by far the most frequent symptoms and seemed to contribute to the learning difficulties. Children who had difficulty in writing seemed to be handicapped by poor eye-hand coordination, and children who could not recognize words often seemed to have disturbances in figure-ground

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

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

[14]G.W. Getman, "The visuomotor complex in the acquisition of learning skills," Learning Disorders: Special Child Publications of Seattle Seguin School, Vol. I, (Seattle, Washington: Bernie Straub and Jerome Hellmuth Co-publishers, 1965), pp. 49-76.

[15]Grace Fernald, Remedial Techniques in Basic School Subjects, (New York: McGraw-Hill, 1943).

[16]Marion Monroe, Children Who Cannot Read, (Chicago: University of Chicago Press, 1932).

> perception. Other children were unable to recognize a letter or word when it was printed in different sizes or colors, or when it was printed in upper-case print and they were used to seeing it in lower-case. It was postulated that these children had poor form constancy.
>
> Like everyone else who has worked with young children, we noticed that many children produced letters or words in "mirror writing." Such reversals or rotations indicated a difficulty in perceiving position in space, while interchanging the order of letters in a word suggested difficulties in analyzing spatial relationships (as well as indicating the possibility of auditory perceptual difficulties).
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> As a rule, these latter children could neither read nor spell longer words. It was also observed that many of the children with evident disabilities in visual perception had difficulty in paying sustained attention and/or showed behavioral deviations.[17]

These observations lead to her work in developing the Marianne Frostig Developmental Test of Visual Perception and the Frostig Program for the Development of Visual Perception. Although Frostig believes that visual perception is probably the most important perceptual function and therefore emphasizes it in her assessment procedures and remedial program, she by no means postulates that they are the only functions important to learning success. Her evaluation of the developmental status of the child includes measurement of sensory-motor abilities, language, perception, thought processes and emotional and social maturity.[18]

Although its use is wide-spread throughout the United States and Canada, the Frostig Test has been studied relatively little.

Questioning the lack of significance tests with respect to the statement of Frostig et al that the greater degree of subtest scatter of the children with learning handicaps "suggests that distinct functions

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[17] Maslow, Frostig, Lefever and Whittlesley, op. cit., p. 464

[18] Marianne Frostig, "The education of children with learning disabilities," Progress in Learning Disorders, ed. H. Myklebust, (New York: Grune and Statton Inc., 1967), p. 239.

of visual perception can be disturbed independently and to varying degrees,"[19] Corah and Powell conducted a factor-analytic study to determine what common factors did in fact exist in the test scores and what proportion of the subtest variance was specific. The results of this analysis showed that two major factors would account for most of the variance. They were general intelligence and developmental changes in perception. The results also suggested that the Perceptual Quotient has a good age standardization, a low relationship with IQ and may be a good measure of perceptual development.[20]

Working on Vernon's premise that children who have reading problems show perceptual difficulty in their inability to recognize significant details, distinguish one letter from another and feel confusion in direction of letters and words, Olson conducted a study to determine if the Frostig test predicted specific reading difficulties, i.e., paragraph comprehension, word recognition, hearing sounds in words, visual memory, using reversible words in context, with a second-grade population. He found that the individual tests on the Frostig Test appeared to have little relation to either Mental Age or Chronological Age, and from these results concluded that the Frostig Test was of little value in predicting the specific reading abilities of the students tested in this study.[21]

Jacobs, assuming that the Frostig Test has construct validity, conducted a study with the purpose of determining whether children respond with higher scores on the test after completion of the perceptual training program, and whether the effectiveness of the subsequent

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[19]Frostig, Lefever and Whittlesley, op. cit., p. 392

[20]Norman Corah and Barbara Powell, "A factor-analytic study of the Frostig Developmental Test of Visual Perception," Perceptual and Motor Skills, 16:59-63, 1963.

[21]Arthur V. Olson, "The Frostig Developmental Test of Visual Perception as a predictor of specific reading disabilities with second-grade children," Elementary English, 43:869-72.

program (Frostig Program for the Development of Visual Perception) might be related to age of intervention. The study revealed that experimental first graders gained most from the Frostig Program over controls, with prekindergarten children gaining second most and kindergarten children showing no gain on the Frostig Test. This was contrary to the prediction that prekindergarten children would gain most. Again, contrary to prediction, it was found that no significant differences in achievement on reading readiness tests existed for kindergarten children. Jacobs concludes that "while there is sufficient evidence that the Frostig Program does increase Frostig visual perceptual scores, the question still remains whether these visual perceptual gains favourably influence reading achievement."[22]

Test evaluators Anderson and Austin disagree in their evaluation of the Frostig Test. Although they do agree that the aesthetic quality and directions for the test are but mediocre, Anderson feels that the Frostig test has been prematurely offered as a finished product in that its standardization is incomplete and the theoretical position of the authors inadequately stated or demonstrated. Austin, on the other hand feels that it is indeed a valid adequately standardized scale for the prediction of learning difficulties.[23]

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[22]Jacobs, op. cit., pp. 332-40.

[23]Mary Austin and James Anderson, quoted in The Sixth Mental Measurements Yearbook, edited by O.K. Buros, (New Jersey: Gryphon Press, 1965), No. 553.

CHAPTER III

PROCEDURE

TESTS TO BE USED

The Marianne Frostig Developmental Test of Visual Perception

Standardization. The most recent standardization (1963) is based on the responses of over two thousand public school children who lived in Southern California and who were between the ages of three and nine years, who were tested on the 1961 edition of the Frostig Test. The authors recognize that the sample was far from perfect as most subjects were from the middle calss areas near to the Marianne Frostig School of Educational Therapy and included no Negro children. The normative curves drawn from the standardization sample indicate that the maximum perceptual growth measured occurred between the ages of four and seven with less growth after the age of approximately seven and one-half years when cognitive functions begin to predominate.[24]

Items. The criteria for the final selection of the items in each subtest area were good age progression and low contamination with other abilities. The child is required to attempt carefully graded tasks in the five areas of visual perception.[25,26]

1. Eye-hand Coordination: The child's task is to draw straight and curved lines within increasingly narrow boundaries or to draw a straight line to a target. Poor performance indicates that writing may be difficult for the child and that kinesthetic methods used in

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[24] Maslow, Frostig, Lefever and Whittlesley, op. cit., p. 467.

[25] Ibid. p. 466

[26] Marianne Frostig, "Testing as a basis for educational therapy," The Journal of Special Education, 2:19-20.

remedial reading are likely to have only limited success.

2. Figure-Ground: The child is asked to discriminate between intersecting shapes and to find hidden figures. Difficulties in this area are parallelled by difficulties in sustaining and shifting attention and rigidity in thought processes.

3. Form Constancy: The task here is to discriminate differently shaded and sized squares and circles placed in different positions among shapes. Low scores on the Form Constancy subtest are claimed to predict problems with the recognition and discrimination of letter forms and transfer of reading skills from one context or size of print to another.

4. Position in Space: This subtest explores the child's concept of directionality. The child is asked to differentiate between figures in an identical position and those in a rotated position. A child with difficulties in this area is thought to have poor body awareness, especially with respect to the left and right sides of his body. He might also have problems with discriminating between letters with the same form but different direction such as 'b' and 'd'.

5. Spatial Relations: The task is to copy patterns by linking dots. A disability in this area is claimed to affect a child's ability to learn to read and spell. It will be difficult for him to construct words from letters and syllables and to recognize the sequence of letters in a word.

Materials. The test consists of a booklet of outline drawings. The examiner needs, in addition, an administration and scoring manual, a set of demonstration cards, coloured chalk (white, green and red) a chalkboard, a set of coloured pencils (red, green, brown and blue) along with a black lead primary pencil for each child, and a set of scoring templates.

Administration. Explicit directions for administering the test are given in the manual and should be strictly followed. Optimum numbers for group testing are: Nursery School 1 - 4
Kindergarten 8 - 10

First Grade	12 - 16
Second Grade	10 - 20
Third Grade	20 - 40

Group administration should not be attempted until the children have been in the classroom for at least two weeks. A proctor, in addition to the examiner, is helpful but not necessary.[27] The time required for group administration is less than one hour; for individual administration, thirty to forty-five minutes.

Scoring and administration. The manual also provides adequate instructions for scoring the test. Interpretation is based on the following concepts:

1. Perceptual Age (PA): This concept is defined in terms of the performance of the average child in the corresponding age group and indicates the child's development in each visual perceptual ability. Although it is criticized on the same basis as Mental Age (MA) because children with the same MA's but different Chronological Ages (CA) will perform differently, it does make easier an explanation to the teacher. For example, she will understand better, "Eight-year-old Johnny cannot differentiate position in space (Subtest 4) as well as a six-year-old boy is expected to do," than "Johnny's subtest score of 8 indicates a need for special training."[28]

2. Perceptual Quotient (PQ): The PQ is defined in terms of constant percentiles above and below the median. A PQ of 90 or less indicates low visual perceptual ability and that help is needed. It is also important that the PQ not be used in isolation from the scale scores obtained in the five subtests because these subtest scores are

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[27]Marianne Frostig, W. Lefever and J.R.B. Whittlesley, Administration and Scoring Manual for the Marianne Frostig Developmental Test of Visual Perception, (Palo Alto: Consulting Psychologists Press, 1966) p. 8.

[28]Maslow, Frostig, Lefever and Whittlesley, op. cit., p. 479

based on the assumption that five different and relatively independent abilities are tested and may be differently trained. Using the PQ as a unitary measure of perceptual function may suggest that it expresses some common trend or factor.[29]

The manual for the Frostig Test includes tables which allow the examiner to easily convert raw scores to scale scores and the scale scores to PQ for three-month age intervals from 4-0 to 7-11, raw scores to PA equivalents and PQ to the equivalent percentile rank. These tables are not suitable for children who are ten years old or over, regardless of their raw scores and PA in planning remedial porgrams on the basis of the Frostig Test, the lowest and highest scores made by the child are of major importance. The abilities in which the child is deficient will be the focus of remediation. His perceptual assets can be used to master new material.[30]

The Clymer-Barrett Prereading Battery

Standardization. The Clymer-Barrett was standardized using 5,565 Kindergarten and first-grade children. It has a split-half reliability coefficient of .96 for the short form and .97 for the long form with coefficients ranging from .90 to .97 for the individual subtests. The norms provided give both a percentile rank and a stanine equivalent for both the long and short forms.[31]

Items. The Clymer-Barrett is designed for use at the end of Kindergarten or the beginning of Grade One. It consists of three subtests each containing two sections.

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[29]Maslow, Frostig, Lefever and Whittlesley, op. cit. p. 481.

[30]Ibid. pp. 469-78

[31]Theodore Clymer and Thomas Barrett, Clymer-Barrett Prereading Battery: Preliminary Manual Form A with Norms, (Princeton: Personnel Press, Inc., 1967), pp. 14-16

1. Visual Discrimination:

   Letter Recognition: The child is required to find the letter of the alphabet given by the examiner.

   Word Matching: The task here is to choose from four similar words the word which is identical to the stimulus word.

2. Auditory Discrimination:

   Beginning Sounds: The child must choose the picture whose name begins with the same sound as the one given by the examiner.

3. Visual Motor Coordination:

   Shape Completion: The task here is to add the missing elements to make an incomplete figure look like the completed figure.

   Copy-a-Sentence: The child must copy a sentence exactly from a model.[32]

Materials: Each child needs a test booklet and a pencil: the examiner, an administration manual, the key and, if desired, a stopwatch.

Administration: The test is so designed that it can be administered in either of two forms:

1. Long Form: This employs all six subtests, takes three periods of about thirty minutes each and yields three diagnostic subtest scores and a battery total.

2. Short Form: This employs subtests 1 and 3 only, takes one period of about thirty minutes and yields a single score. This form is the more suitable for screening.[33]

The test is administered either in a group or to the individual pupil. The preferred procedure is that of giving the entire battery at

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[32] Clymer and Barrett, op. cit., pp. 5-11

[33] Ibid. pp. 3-4

one sitting observing the following schedule:

Period I Letter recognition and word matching

Period II Discrimination of beginning sounds and ending sounds

Period III Shape completion and copy-a-sentence

After the first test in each period a few moments of passive rest are given in the children's desks, and after Period I and Period II, a few minutes for active relaxation.

The manual includes explicit instructions for administration.

Scoring and Interpretation. A scoring key is provided which gives the correct answers to each item and provides directions for scoring each of the battery subtests. The norms provide a stanine equivalent for each subtest area and for the full form and the short form. Also given are percentile ranks for the total raw scores for each form. Children whose percentile ranks are 40 or below are considered to need extra attention.[34]

The Clymer-Barret was chosen as the measure for reading readiness because it has good positive correlations with end of first-reading achievement,[35] because it includes those skills commonly assumed to be good predictors of reading success and because it is widely used in the schools of British Columbia.

SUBJECT SELECTION

Subjects for this study were taken from the Grade One population of Prince George School District. Grade One was chosen because previous study has shown that the largest gains in perceptual skills as measured by the Frostig, and reading readiness skills as measured by various readiness batteries in children who have received the Frostig Program occur at the first-grade level.[36] Three schools were involved in the

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[34] Clymer and Barrett, op. cit. pp. 12-13

[35] Ibid. p. 16, Table 7. [36] Jacobs, op. cit., pp. 339-40

experiment: Quinson, Harwin and Central Fort George. These schools were selected because of their proximity to each other. During the last week in September and the first week in October, the Frostig Test was administered to all the children in the three classes, exactly according to instructions, with no group larger than sixteen. Those children who obtained a PQ of 90 or less on the Frostig Test were then administered the Clymer-Barrett (long form) as well. Those children who scored 90 or less on the Frostig and at the 40th percentile or less on the Clymer-Barrett then became subjects for the experiment. The total number of pupils involved was thirty-two, with ten at Quinson, twelve at Harwin and ten at Central Fort George. These children were assigned randomly to the experimental or control groups. The control group consisted of fifteen children; the experimental, of seventeen.

ADMINISTRATION OF THE PROGRAM

The experimenter went into each class three times a week for six weeks for a sixty to seventy-five minute session. In an effort to maintain the semblance of a regular classroom situation, the experimenter worked with the whole class, teaching both the control and experimental groups. The sessions were rotated on the following schedule:

Day/Time	9:15-10:30	1:00-2:10
Monday	Quinson	Central Fort George
Tuesday	Harwin	Quinson
Wednesday		Central Fort George
Thursday	Harwin	Quinson
Friday	Central Fort George	Harwin

Each class consisted of approximately three ability groups which could be taught together or separately as the lesson of the day demanded. In each session the experimental group was taught as a separate group while the control group was taught as part of whichever ability group they belonged to. The classroom set-up was the conventional or with desks and a small space for group activity. Each room

was provided with a balance board, bean bags, plasticine, felt shapes and other three-dimensional materials all of which were readily available in the school. The stencils for the two-dimensional work sheets used in the program were borrowed from the school district's Central Library and would be available to any teacher who wished to use them. The lessons for the class, including the control group, were worked out with the teacher each day. The Frostig Program was administered according to the Frostig teacher's manual,[37] each lesson being carefully prepared by the experimenter, a primary teacher of four years experience.

Experimental Group. Each session the whole experimental group received ten minutes of physical exercises for coordination, balance, body awareness and eye-movements. They were given ten minutes of individually prescribed and administered two-dimensional exercises in each child's three lowest subtest areas. Each child received three to six worksheets per session, depending on the complexity of the tasks involved. These included a misture of areas so that two-dimensional training in each area was received every day. The remainder of the session was spent on such activities as cutting and pasting exercises, colouring, stringing beads, sorting shapes, building plasticine objects, drawing, building with blocks, all of which require a minimum of teacher supervision but are suggested as suitable in the program. To follow Frostig's philosophy that the program must be an integrated one in which other skills than the visual perceptual stressed by the Frostig Program are developed,[38] the children followed the program of their ability group on days when there was no session.

Control Group. The control group received the regular reading and reading readiness program as prescribed by the B.C. course of study

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[37] Frostig and Horne, op. cit.

[38] Frostig in Johnson and Myklebust, op. cit., p. 249.

for the primary grades in the Copp-Clark[39] or Language Experience[40, 41] series, with their particular ability group. In each class, although the Copp-Clark approach was followed, it was supplemented with ideas from the Language Experience Programs. The activities included:

low ability: nursery rhymes, story sequences, naming objects, describing pictures, fairy tales, auditory and visual discrimination, rhyming, colour recognition, categorization, drawing, cutting and pasting and printing.

Middle and high ability: picture discussion and construction of experience charts, word recognition, visual and auditory discrimination, rhyming, listening for story sequence, categorization, phonetic analysis, oral and silent reading skills, printing sentences and stories.

During the session, there was usually one group doing work with the teacher (experimenter) while two groups were working independently.

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[39]Barbara R. Mercer, Teacher's Manual to Accompany Off to School, (Vancouver, Copp Clark, 1962).

[40]Theodore Clymer, Bernice M. Christenson, David H. Russell, Manual For Building Pre-Reading Skills, Kit A, Language, (Boston: Ginn and Co., 1965)

[41]Elizabeth A. Thorn, Anne McCreary-Juhasz, Audrey C. Smith, K.D. Munroe, M. Irene Richmond, Language Experience Reading Program: The Teacher's Sourcebook, Level I, (Toronto, W.J. Gage, Ltd., 1966).

CHAPTER IV

RESULTS

Retesting

Within three days of the completion of the program, each subject was retested on the Frostig and Clymer-Barrett exactly according to instructions.

Analysis of the Data

To test the hypothesis that children given the Frostig Program in the regular class will make significant gains on the Frostig Test over children receiving the regular program, the difference between pretest and posttest scores on the Frostig Test was found for each child as demonstrated in the table on the following page. The mean improvement was found to be 17.25 for the experimental group and 14.2 for the control group. These were compared using the two-sample t-test and the results were found to be insignificant at the .05 level.[42]

To test the hypothesis that children, given the Frostig Program in the regular class, will make significantly greater gains in the reading readiness skills, as measured by the Clymer-Barrett, over children receiving the regular program, the difference between pretest and posttest scores on the Clymer-Barrett was found for each child. The mean improvement was found to be 14.235 for the experimental group and 13.267 for the control group. These were compared using the two-sample t-test. The results were found to be insignificant at the .05 level.[43]

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[42] See the Appendix for calculations.

[43] See the Appendix for calculations.

TABLE I

PRETEST, RETEST AND DIFFERENCE SCORES ON THE FROSTIG AND CLYMER-BARRETT

	FROSTIG			CLYMER-BARRETT		
Subject	Pretest	Retest	Difference	Pretest	Retest	Difference
Experimental						
Donna	87	87	0	38	36	- 2
Bobby	87	110	23	12	29	17
Clive	70	80	10	26	53	27
Clifton	87	102	15	32	31	- 1
Laurie	85	110	25	28	44	16
Denise	66	82	16	5	9	4
Laurie	89	120	31	14	30	16
Wade	83	100	17	13	23	10
Allan	76	96	20	5	12	7
Jasper	87	83	- 4	8	9	1
Greg	80	99	9	19	23	4
Karla	42	70	28	1	2	1
Mac	85	102	17	23	51	28
Sharlyne	89	103	14	39	61	22
Kenneth	85	104	19	13	30	17
Steve	85	121	36	35	75	40
Michelle	85	102	17	28	53	25
Control						
Lincoln	82	98	16	18	44	26
Tony	87	94	7	21	47	26
Debbie	87	98	12	31	34	3
Larry	89	100	11	24	47	23
Debora	81	94	13	37	71	34
Karen	72	90	18	28	41	13
Laurie	87	102	15	40	32	- 8
Wendy	82	77	- 5	24	29	5
Diane	83	105	22	19	50	31
Robert	70	80	10	16	16	0
Alan	85	100	15	18	29	11
Colin	90	96	6	5	21	17
Violetta	58	87	29	6	4	- 2
David	73	100	27	30	36	6
Gino	87	104	17	31	47	16

CHAPTER V

CONCLUSIONS AND DISCUSSION

According to the results obtained in this study, the Frostig Program was not succesful in significantly increasing perceptual skills as measured by the Frostig Test nor in significantly increasing reading readiness as measured by the Clymer-Barrett. As increased reading readiness is the ultimate goal in developing the perceptual skills, one could conclude that the test and the program are of limited usefulness in the regular classroom and, therefore, should not be used except in the clinical setting. However, the results give rise to some doubts and questions which point to further investigation before such a conclusion is drawn.

First of all, it is interesting to note that in a pilot training study done in the Kindergarten classes of five schools in Hermosa Beach, California, the children trained in eighteen sessions of eighty-five minutes each (including a "milk break" and recess) gained significantly more on the Frostig Test than did children in the control group trained according to prescribed school curriculum.[44] The children in this study received eighteen sessions of an average of sixty-eight minutes each, not including recess, but did not show a significant improvement. From this we could hypothesize that perhaps the first-grade children used here had gone beyond the age of fastest development. This, however, would not be supported by Jacobs who found the fastest rate of develop- occurring at the first-grade level.[45] It would be interesting to see if Kindergarten children taught in the regular classroom would improve significantly more.

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[44] Maslow, Frostig, Lefever and Whittlesley, op. cit. p. 496.

[45] Jacobs, op. cit., p. 338.

One might also hypothesize that the difference lies in the fact that the pilot-study children were taught by specially trained teachers.[46] The experimenter was not specially trained in this area but was definitely aware of the developmental sequence through which children pass, and studied the test and program very carefully before attempting to teach by it, as would a regular classroom teacher. The difference could also be explained by the fact that the pilot-study children were removed from the classroom for intensive training at the Frostig Center. It would appear to the experimenter that this is probably the most pertinent explanation in that the intense training could be given without interruption from children in other groups. The experimenter observed that even when the time was exactly planned, it was very rushed to complete the session's work with every group. It was also apparent that these first-grade children, most of whom had not had Kindergarten, had not yet developed the independence nor self-discipline to work on their own for any length of time and that steady interruptions occurred. Perhaps, in order for the program to be successful in the regular classroom it should be carried over a longer period of time allowing for interruptions and a more relaxed approach.

It may be also that significant results were not obtained by this particular experimenter. If one could conduct a similar experiment with a random sample of teachers and classes, perhaps the results would again be different because one would supposedly have a normal distribution of teacher characteristics as well as pupil characteristics.

It would appear, then, that before drawing any conclusions as to the usefulness of the Marianne Frostig Developmental Test of Visual Perception and the Frostig Program for the Development of Visual Perception in the regular classroom, further investigation controlling the variables of class size, number of sessions and age of the subjects would be in order.

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[46] Maslow, Fristig, Lefever and Whittlesley, op. cit. p. 496.

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APPENDIX I

CALCULATIONS FOR HYPOTHESIS I

1. Null Hypothesis: The experimental group did not improve significantly more than the control group when retested on the Frostig Test.

2. Statistical Notation of the Null Hypothesis:

$$H_o: \mu_c = \mu_e \rightarrow \mu_c - \mu_e = 0$$

$$H_1: \mu_c \neq \mu_e \rightarrow \mu_c - \mu_e \neq 0$$

3. If H_o is true, then

$$t_{ob} = \frac{(\bar{X}_e - \bar{X}_c) - 0}{\sqrt{Sp\ 1/Ne + 1/Nc}} \sim t_{(Ne + Nc - 2)}\left(0\ \frac{v}{v-2}\right)$$

where $v = N_1 + N_s - 2$

4. Assumptions: The variances are equal but unknown for the population.
   The samples are random.
   Independent observations, i.e., every child worked on his own.
   The sample approximates the normal curve.

5. Decision Rule: $\alpha = .05$

   Reject the null hypothesis if t_{ob} is less than 1.96 or more than + 1.96.

6. Data: $X_e = 17.25$ $\quad S_e^2 = 53.7$

   $X_c = 14.2$ $\quad S_c^2 = 70.87$

7. $$t_{ob} = \frac{(\bar{X}e - \bar{X}c) - 0}{\sqrt{Sp^2/Nc + Sp^2/Ne}} \quad \text{where } Sp^2 = \frac{(Nc - 1)(Sc^2) + (Ne - 1)(Se^2)}{Nc + Ne - 2} = 61.71$$

$$t_{ob} = \frac{3.05}{2.775} = 1.099$$

8. Accept the null hypothesis and reject the hypothesis that there is a significant difference.

APPENDIX II

CALCULATIONS FOR HYPOTHESIS II

1. Null Hypothesis: The experimental group did not improve significantly more than the control group when retested on the Clymer-Barrett.
2. Statistical Notation of the Null Hypothesis: See Appendix I.
3. See Appendix I.
4. Assumptions: See Appendix I.
5. Decision Rule: $\alpha = .05$

   Reject the null hypothesis if t_{ob} is less than -1.96 or more than +1.96.
6. Data: $X_e = 14.235$ $\quad S_e^2 = 143.441$

   $X_c = 13.267$ $\quad S_c^2 = 163.638$
7. $t_{ob} = \frac{.986}{4.38} = .225$