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An Evaluation of the Frostig Visual-Perceptual Training Program

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Introduction

AUTHORITIES in the fields of education and psychology have, for a considerable period of time, recognized the critical need to identify and institute a remediation program for those children who are likely to encounter extreme difficulties in learning to read. Although there has been a general recognition of this need, productive remediation and diagnostic procedures have not as yet been adequately developed.

The traditional approach to this problem has been to obtain some global measure of a child's intellectual capacity, generally without taking notice of specific areas of strengths and weaknesses, and to determine his "reading readiness," using instruments that rely heavily on the child's early cultural opportunities. Remediation procedures for these children have, for the most part, been absent or, if present, were based on a trial and error method.

One promising method of early prediction, diagnosis, and remediation of reading difficulties is the Marianne Frostig Developmental Test of Visual Perception, and a rather complete visual-perceptual training program to be used in conjunction with the test. The test appears to be potentially very useful inasmuch as it not only claims to predict reading success, but also gives some indications of specific areas in which the child has visual perceptual difficulties.

Frostig developed her 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. Cruikshank (2), Ayres (1), and Kephart (4) appear to be in general agreement with Frostig concerning discrete areas of visual-perceptual development. Cruikshank feels that visual-perceptual difficulties are often not of a general nature; Ayres and Kephart implicitly indicate the same by the development of their testing and training materials.

Another extremely important concept put forth by Frostig (3) is that visual-perceptual skills are developmental in nature and appear to mature most rapidly between the ages of four and seven. Frostig believes that these skills can be taught in a structured program in the classroom.

The Marianne Frostig Developmental Test of Visual Perception taps visual-perception skills in five areas: Eye-Motor Coordination; Figure-Ground Perception; Perception of Form Constancy; Perception of Position in Space; and Spatial Relationships.

Frostig (3) describes the tasks involved in her tests as follows:

In Eye-Hand Coordination the child's task is to draw straight and curved lines between increasingly narrow boundaries or to draw a straight line to a target. In Figure-Ground Perception the child is asked to discriminate between intersecting shapes and to find hidden figures.

In the Form Constancy sub-test the task is to discriminate circles and squares in different shading, sizes, and positions among other shapes on the page. The fourth sub-test measures perception of position in space (directionality). The child is required to differentiate between figures in an identical position and those in a reversed or rotated position. In the sub-test of spatial relationships, the task is to copy patterns of linking dots.

The underlying rationale of theoretical validity expostulated by Frostig is seen in the following quotation (3):

Disturbances in visual perception were by far 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 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).

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.

For each of the sub-tests there are norms which yield perceptual age, in years and months, and also permit a conversion of raw scores to standard scores. In addition, the child's total per-

formance on the test can be expressed as a perceptual quotient.

The Frostig Visual-Perceptual Training Program was designed to be used in conjunction with the Developmental Test of Visual-Perception. The training program is specifically designed so that any part, or the entire program, can be used with each child.

Purposes of the Study

Assuming the Frostig test has construct validity, i.e., ability to read is a function of the visual perception factors identified, one purpose of this study is to determine whether children respond with higher scores on the test after completion of the perceptual training program. To achieve this evaluation, the effects of the program must be distinguished from score increase due to normal development. The program is evaluated at three age-grade levels in order to determine whether its effectiveness might be related to age of intervention.

Procedures

In September 1965, three schools with large proportions of disadvantaged children were selected for this study. The schools were chosen because all contained prekindergarten classes and were interested in participating in the Frostig program.

In each of the three schools, six classes were selected: two prekindergarten classes, two kindergarten classes, and two first grade classes. Thus, over the three schools, there were 18 classes with approximately 500 youngsters who were subjects in this experiment. One class within each grade and each school was selected *at random* and received the Frostig remedial program; other classes were identified as controls.

In September of 1965 both experimental and control classes were given the Frostig Developmental Test of Visual Perception. Starting in September and continuing to June 1966, experimental classes were given the Frostig Visual-Perceptual program, which was not administered to the controls. The Frostig Test was readministered in May of 1966 or approximately ten months after the pretest.

In addition to the Frostig Test, experimental and control kindergarten classes were administered the Metropolitan Reading Readiness Tests in May 1966.

Supervisory staff who were familiar with the Frostig Program met with nine teachers responsible for implementing the Frostig Program. Training sessions were held early in the school year in order for teachers to understand the various lessons and services connected with the Frostig Program.

The Frostig Tests were administered by the Division of Psychological Services within the framework of the regular classroom. Reading readiness tests were also administered by trained examiners from the Division of Evaluation Services.

Hypotheses. Several hypotheses were tested in relation to the purpose set forth above.

1. Experimental pupils will show greater gains on the Frostig test from September to May than will control pupils. This result is expected simply because the Frostig test is intrinsically related with the Frostig remedial program itself.

2. Younger pupils in the experimental group will show larger gains than older

pupils. This hypothesis is based on the finding of numerous studies that the earlier the age of intervention, the more effective is the treatment. It will be recalled that Marianne Frostig suggests that these visual-perceptual skills develop between the ages of four and seven.

3. Kindergarten children in the experimental group will score higher on a traditional reading readiness test than control pupils. This expectation is based on the assumption that traditional reading readiness tests contain a significant amount of content relating to visual-perceptual skills.

Design and Methods of Analysis

Three measurements were involved during this first year of the study. Two measurements result from administering the Frostig test during the fall and spring of 1965-66. The third measurement is the Metropolitan Reading Readiness Tests administered to kindergarten pupils at the end of the year.

The design of the study is represented by experimental and control treatments, each applied to prekindergarten, kindergarten, and first grade classes. Since there was no assurance that experimental and control pupils would be similar at the beginning of the experiment, covariance analysis procedures were applied to the Frostig post-test (Frostig) achievement. The result is a two-way analysis of covariance. For ease of computation, an equal number of pupils was selected *at random* in each of the six cells in the design. Covariance analyses were made as described above on the total score of the Frostig test.

Results

Effects of Frostig Program upon Frostig Test Scores. The results of administering the Frostig tests in September and May to experimental and control classes are shown in Table 1. (See page 12.) These scores are composite or total scores based on all five sub-tests.

Inspection of Table 1 indicates that pupils in the experimental group began the year with a lower average score (41.46) than did the control group (43.68), yet ended the year with a higher average score (47.81) than the control group (46.16). The average score gain for experimental pupils in all three grades was 6.35, as compared with 2.48 for controls.

It may be noted that the pretest means of the experimental group among all three age-grade levels are highly similar. Among the control groups, on the other hand, pretest scores do increase from prekindergarten to kindergarten level but remain essentially the same from kindergarten to the first grade. This observation would indicate that the skills measured by the Frostig Test do not develop normally among the types of pupils in this experiment. This would suggest that special stimulations such as those produced by the Frostig Program are needed to develop these perceptual skills.

The table also shows that at each grade level the control group scored higher than the experimental group on the pretest. These differences, however, were cancelled out by the covariance analysis.

F-tests resulting from the covariance analysis of treatments, grades, and treatments by grade interaction, were all significant beyond the 5 percent point. Thus, the experimental groups as a whole scored higher at the end of the

Grade Level	Treatment: Experimental (Frostig Program)	Treatment: Control	Combined Grade Means
Prekindergarten			
September	40.55*	41.42	40.98
May	43.06	41.29	42.18
Gain	+ 2.51	− .13	+ 1.20
Kindergarten			
September	41.84	44.26	43.05
May	48.29	49.16	48.73
Gain	+ 6.45	+ 4.90	+ 5.68
First Grade			
September	42.00	45.35	43.68
May	52.06	48.03	50.04
Gain	+10.06	+ 2.68	+ 6.36
Treatment Means			
September	41.46	43.68	42.57
May	47.81	46.16	46.99
Gain	+ 6.35	+ 2.48	+ 4.42

* Each cell mean is based on 31 pupils. The scores reported are the sums of five scale scores, each of which is defined as perceptual age divided by chronological age, multiplied by 10. A total scale score of 50 is equivalent to a perceptual quotient of 100.

Table 1. Mean September and May Frostig Test Scores and Gains Made by Experimental and Control Groups on the Frostig Test of Visual Perception by Grade Level

year on the Frostig tests than did the control groups. Grade differences also were significant, as expected, with older pupils scoring higher on the average than younger pupils.

Of importance, however, was a significant interaction effect, which is seen in Table 1 by noting that the largest difference in achievement gains between experimental and control groups appeared at the first grade level, while less difference, still favoring the experimental groups, appeared at the prekindergarten and kindergarten levels.

As an aid to understanding these results, Table 2 presents the post-test means *adjusted* for differences in pretest achievement for each of the six groups. The adjusted means, in effect, cancel out any pretest differences so that direct comparisons among posttest scores can be made.

Table 2 shows that the adjusted mean difference between experimental and control groups is 2.64, favoring the experimental group. The significant interaction effect is easily seen in the difference column of Table 2. The Frostig Program was most effective at the first grade level (difference = 5.64), followed by the prekindergarten level (2.19). The difference of .10 at the kindergarten level between experimental and control children was not significant.

Contrary to the hypothesis (two), the largest gains occurred among the older rather than the younger children. The means and gains do show a consistent relationship with age-grade level among the experimental groups but *not* among the control groups. Thus, the experimental (adjusted) means increase from 44.05 to 48.66 to 52.35 from prekindergarten, to kindergarten, to grade one respectively, as compared with 41.86, 48.56, and 46.71 for the control groups.

One explanation of the interaction may be inferred from the curriculum of control groups at the age-grade levels. The normal first-grade curriculum emphasizes beginning reading, not the type of skills contained in the Frostig remedial program. Thus, the communality of curriculum content between experimental and control classes may be *least* at the first grade level.

On the other hand, the similarity of curriculum between experimental and control groups at the kindergarten level may be greatest, i.e., the normal kindergarten program may develop and emphasize the same skills as the Frostig Program, with the result that little difference is observed. Consistent with the latter reasoning, the present prekindergarten curriculum may have an intermediate similarity with the Frostig Program.

Sub-test Analyses. The same analytical procedures used for total scores were applied also with sub-test scores. Thus, covariance analyses were made, adjusting post-test (May) scores for differences in pretest (September) achievement. Rather than a series of tables similar to Table 1, a summary table of adjusted sub-test scores similar to those shown in Table 2 is presented along with a summary of F-tests. These data are found in Table 3. (See page 15.)

Table 3 presents some interesting results relative to specific sub-tests. First, it is noted that there was no significant difference between experimental and control groups in any of the sub-tests except that of form constancy. Why the form constancy sub-test responded to the Frostig Program (in comparison to controls), while the remaining four sub-tests showed no significant difference from the controls is unknown. Of further interest is the fact

Grade	Treatment		Difference (E-C)
	Experimental (Frostig)	Control	
Prekindergarten	44.05	41.86	+2.19
Kindergarten	48.66	48.56	+ .10
First Grade	52.35	46.71	+5.64
Treatment Means	48.36	45.72	+2.64

Table 2. Post-test Scores Adjusted for Pretest Differences for Experimental and Control Groups by Grade Level

that grade differences were apparent in all sub-tests *except* form constancy. From this result one might infer that form constancy is least likely to develop normally among disadvantaged children without special remedial effort.

Interaction between treatments and grade levels was significant in all subtests except figure-ground. The form constancy, position in space, and spatial relationships sub-tests all showed the interaction to favor the Frostig Program at the first grade level. In the eye-motor coordination sub-test, the interaction favored the Frostig Program at the prekindergarten level.

Effects of Frostig Program upon Reading Readiness Scores. Kindergarten pupils in the Cincinnati Public Schools are given the Metropolitan Reading Readiness tests during the spring of the year to provide first grade teachers with some basis for grouping in reading. It was hypothesized that experimental pupils in the Frostig Program would show higher scores on the reading readiness tests than control group pupils.

A covariance analysis was made to test the difference between the group of kindergarten pupils who were enrolled in the program and the control group. The reading readiness scores were compared after appropriate adjustments to compensate for differences in pre-program achievement. These adjustments were based on the differences in September Frostig scores, which favored the control groups.

The raw scores on the Metropolitan Reading Readiness Test for the experimental group was 38.26, while for the control group it was 40.38. When appropriate adjustment was made in the reading readiness scores, the result was 40.02 for the experimental group and 38.62 for the control group. The latter difference of 1.40 favoring the experimental group was tested and found to be nonsignificant. Thus, there is no evidence in this experiment to support the hypothesis that kindergartners who have participated in the Frostig Program for nine months perform better on a reading readiness test than those who were not enrolled in such a program.

Discussion

The main focus of this investigation was to test the hypothesis that children in early grades would show greater gains on the Frostig Test after having completed the Frostig Remedial Program than would a group of control pupils not receiving the remedial program. This hypothesis was confirmed but with some important conditions. The experimental groups in prekindergarten, kindergarten, and first grade classes did not make equal gains in relation to controls, i.e., there was interaction between treatment and grade level.

In general, the source of the interaction revealed that first graders gained most from the Frostig Program in comparison to controls, prekindergarten children benefiting second most, and kindergarten children showing no difference in gain on the Frostig Test.

It is possible that the effectiveness of the Frostig Program is a function of its interaction with the ongoing curriculum. Such an explanation would take the emphasis off the normal development of visual perception skills with maturity. It is also possible, of course,

Grade Level	Experimental	Control	Difference (E-C)	Summary of Covariance Analyses Significance of F-ratios at 5% point: Treatment Difference	Grade Difference	T x G Interaction
			Sub-test 1: Eye-Motor Coordination			
Prekindergarten	9.27	8.27	+1.00			
Kindergarten	9.35	10.51	−1.16	No	Yes	Yes
First Grade	9.27	10.05	− .78			
Total	9.30	9.61	− .31			
			Sub-test 2: Figure-Ground			
Prekindergarten	8.85	8.26	+ .59			
Kindergarten	10.48	10.03	+ .45	No	Yes	No
First Grade	10.50	10.41	+ .09			
Total	9.94	9.57	+ .37			
			Sub-test 3: Form Constancy			
Prekindergarten	9.72	9.21	+ .51			
Kindergarten	10.54	9.35	+1.19	Yes	No	Yes
First Grade	11.66	7.99	+3.67			
Total	10.64	8.85	+1.79			
			Sub-test 4: Position in Space			
Prekindergarten	7.80	7.67	+ .13			
Kindergarten	9.30	9.69	− .39	No	Yes	Yes
First Grade	10.08	8.68	+1.40			
Total	9.06	8.68	+ .38			
			Sub-test 5: Spatial Relations			
Prekindergarten	7.91	8.09	− .18			
Kindergarten	9.27	9.41	− .14	No	Yes	Yes
First Grade	10.37	10.00	+ .37			
Total	9.18	9.17	+ .01			

Table 3. Summary of Post-test Frostig Sub-test Scores Adjusted for Pretest Differences Among Experimental and Control Groups by Grade Level

that, since the pupils in the experiment are considered disadvantaged, the normal development of visual perceptual skills among these children may differ from that of the children from higher socioeconomic backgrounds.

The second hypothesis tested was that higher gains would result among younger pupils as compared with older pupils who completed the Frostig Program. The facts confirm just the reverse of this hypothesis. The largest gains

occurred among experimental first grade pupils, and kindergarten pupils gained more than prekindergartners.

Explanation of these results is difficult since the normal rate of development of these perceptual skills, according to Frostig, occurs most rapidly at earlier ages, starting at approximately age three. These results might be explained through some uncontrolled variables or, possibly, again through the interaction of the ongoing curriculum with the Frostig Program.

The third hypothesis tested was that the Frostig Program would result in pupils' scoring higher than control pupils on a reading readiness test. This test was made on kindergarten children only. When reading readiness scores were adjusted for initial differences in achievement as measured by the September Frostig test, no significant difference was found. Although the experimental group did score slightly higher than the control group on the reading readiness test, the difference was not sufficient to be significant.

This experiment will be continued next year with a new group of prekindergarten pupils and, if possible, on the same pupils who will advance one year in grade. While there is sufficient evidence that the Frostig Program does increase Frostig Visual Perceptual scores, the question still remains as to whether these visual perceptual gains favorably influence reading achievement. At the end of the second grade, one year after completing the Frostig Program, the first graders in this study will be tested with the Gates Primary Reading Test.

It is planned that next year the same hypotheses tested within this report will be tested again. It is expected that the cumulative effects of the Frostig Program will increase the differences between experimental and control pupils.

Assuming that visual perceptual skills do form the basis for reading readiness, it would seem most urgent that a remedial program such as the Frostig Program be initiated in classes of disadvantaged children. This urgency arises from the fact that little development from ages approximately four to six seems to occur as a result of normal maturation. Within the experimental group, for example, pretest scores were approximately the same when these youngsters were ages four, five, and six.

Among the control groups there was some increase from ages four to five, but very little from ages five to six. Even if these small increases were significant, they are certainly not sufficient for the child to reach normative performance. Until further evidence becomes available, it does appear that the Frostig Program is more effective in the first grade level.

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