STUDY OF THE EFFECTS OF A PROGRAM FOR THE
DEVELOPMENT OF VISUAL PERCEPTION

A THESIS SUBMITTED TO THE HONORS COMMITTEE
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Approved
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A Statement of the Problem

This study was undertaken to determine the positive effect the Marianne Frostig Program for the Development of Visual Perception might have on a group of primary educable children. Five specific areas of visual perception are developed by this program. They are (1) eye-hand coordination, (2) figure-ground perception, (3) perception of form constancy, (4) perception of position in space, and (5) perception of spatial relationships. Visual perception is thought to be one of the major areas of development for children of this mental age range. Therefore, a knowledge of perceptual development may be a good indication of the child's total development.

Hypotheses

I. After twelve weeks of training, primary educable retarded children will show general improvement in the five areas of visual perception to be developed by the Frostig program.

II. Children with previously determined intelligence quotients from sixty-six to seventy-nine will show a greater degree of improvement than will children with intelligence quotients of fifty to sixty-five.

III. Children who have previously attended classes for the educable mentally retarded will make more gains with this program.
than will the children who are attending the "educable" class for their first year.

IV. Girls in the study will show greater improvement as determined by the pre-training and post-training test than will the boys in the study.

Overview

Visual perception is an important factor in learning and living. It is described by Asher, Tiffin and Knight (2, p.245) as the process of interpreting and identifying excitations. Perception is determined in part by environmental stimulations and in part by "what the individual is at the moment." If one is aware of factors affecting perception, methods of developing better perception may be enhanced. Morse and Wingo (1962) believe that perception is restricted by certain limits imposed by the sensory receptors and the organizing forces within the nervous system. Selective attention directed in part by individual interest restricts what is perceived by directing the attention toward specific details. Thus, what is perceived by a person is dependent upon the psychological and physiological make-up of an individual as well as being dependent upon the individual's stimulus pattern. The Encyclopedia of Educational Research says this of perception in general:

What we perceive is not a replica of what is 'out there.' It is a construction determined by the stimulus complex, the physiological properties of the receptors, and poorly understood brain functions called 'central processes.' (p. 242)
Thus, an individual may not perceive what is actually before him but may be influenced by past experiences.

Visual perception can aid or hinder education. Part of the learning process consists of perceiving the specific cue for a specific response, or acquiring more differentiated perception of stimuli. The Encyclopedia of Educational Research (5, p. 942) also states that perception of certain visual forms is necessary to learn to read. Frostig (6, p. 93) wrote that visual-perceptual ability plays an important role in the acquisition of reading, but that other skills are also involved. However, difficulties with visual perception may cause distortion of the meaning of sequentially presented material. This distortion can hinder the reading process. If one is to read printed materials successfully, he must "see" them without distortion. One could not expect to make sense of a jumbled page of print. If better or more true perception can be developed, the individual will have a better chance for using other necessary skills and for learning to read.

Frostig (10, p. 6) also believes visual perception is related to the child's ability to learn and adjust. Perception is thus related to school performance. Clinical work has shown this interdependence between perceptual disturbance and learning and behavior difficulties. In a "normal" sample studied by Frostig, Lefever, and Whittlesey (8, pp. 160-161), the classroom teacher's rating of classroom adjustment which was based on academic achievement and behavior essential to the smooth functioning of the group and of perceptual
development were correlated. A clear connection was found between disabilities in visual perception and poor classroom adjustment at the lower age levels of kindergarten and first grade. The authors explained this connection by stating that any kind of maladjustment at any given age level tends to express itself in a disturbance of the functions which represent for that age the main developmental task. At this age (three to seven and one-half years), the main developmental task is development of speech and perceptual behavior. Therefore, most children showing poor classroom adjustment or learning difficulties at the preschool or lower grade levels are handicapped by disabilities in visual perception (8, p.161).

A study by Elkind, Koegler, Go and Van Doorninck (4, p. 109) shows what effects perceptual training can have upon brain-injured and familial retarded. Although the authors were interested in the comparison of the two groups, it can be noted that they found both groups showed "significant improvement in ambiguous picture perception as a result of perceptual training and that the effects were apparent both immediately and one month after training." Although brain-injured and familial retarded children are not differentiated in the present study, the improvement in visual perception shown by this study shows these children can be aided by perceptual training and improvement due to the perceptual training could be hoped for.

A pilot study on the Frostig Perceptual Development Program is presently being conducted by Allen, Dickman, and Haupt (1, p.41). Their study is of educable mentally retarded children. Two groups of children were tested with the Frostig Developmental Test of Visual Perception for the study. One group was given one semester
of training with the Frostig program while the second group received no training outside of the regular curriculum. When the groups were retested, both groups showed large increases in figure-ground perception, perception of form constancy, and perception of spatial relationships. Both groups showed nonsignificant changes in the areas of eye-hand coordination and perception of position in space. Although both groups showed improvement, the group that had received training showed greater improvement than the untrained group. The authors believe this indicates that special training with the Frostig program can improve the educable retardate's skills in making figure-ground discrimination, in appreciating figure constancy, and in dealing with spatial relationships.

Evaluation of the above literature leads one to recognize the importance of visual perception especially as it pertains to reading, learning and behavior. It also poses the possibility that educable retardates will respond positively to perceptual training in general and to the Frostig Program for the Development of Visual Perception in particular.

Definition of Terms

I. Educable mentally retarded -- Robinson and Robinson (15, p. 461) describe this group as having tested intelligence quotient scores between fifty and seventy-five. They are "expected eventually to achieve academic work at least to the third-grade level." As adults, they are expected to be socially adequate and capable of unskilled or semi-skilled work. Kirk (12, p. 86) further elaborated
that they have potentialities for development of (1) minimum educability in reading, writing, spelling, arithmetic and so forth, (2) the capacity for social adjustment, and (3) minimum occupational adequacy.

II. Visual-perception -- Morgan (13, p. 682) defines perception as an awareness of objects, qualities or events stimulating the sense organs. Frostig (6, p. 93) defines visual perception as a sense channel which conveys information about the outside world. Frostig and Horne (7, p. 16) say that visual perception is the ability to recognize stimuli. Not only are the reception of sensory impressions from the outside world and from one's own body included in this ability. Also, the capacity to interpret and identify the sensory impressions by correlating them with previous experiences is included in the ability to recognize stimuli. This process occurs in the brain, not the eye.

III. Eye-motor coordination -- Included here is "the ability to coordinate vision with movements of the body or with movements of a part or parts of the body," (7, p. 29).

IV. Figure-ground perception -- The figure, as described in Frostig's Teacher's Guide (7, p. 34), is that part of the field of perception that is the center of the observer's attention, and the remaining stimuli in the perceptual field is the dimly perceived ground. An object cannot be accurately perceived unless it is perceived in relation to its ground. If figure-ground discrimination is poor, a person's attention tends to jump to any stimulus that intrudes upon him, or he may have difficulty in screening out
obtrusive stimuli and thus not be able to shift his attention to some other stimuli.

V. Perception of form constancy — Perception of form constancy is defined in the Teacher's Guide (7, p.40) as "the ability to perceive an object as possessing invariant properties, such as shape, position and size, in spite of the variability of the impression on the sensory surface." For example, no matter from what angle one sees a cube, it is perceived as a cube.

VI. Perception of position in space — The Teacher's Guide (7, p. 74) defines this as "perception of the relationship of an object to the observer. This might be in terms of being behind, before, above, below, or to the side of him."

VII. Perception of spatial relationships — This is defined in the Teacher's Guide (7, p. 74) as "the ability of an observer to perceive the position of two or more objects in relation to himself and in relation to each other. All of the objects receive approximately equal attention."
CHAPTER II
PROCEDURE

Subjects

The entire class of fifteen children enrolled in the primary class for educable mentally retarded at Morrison-Mock School in Muncie, Indiana, were used for this study. This is the only primary class of this type in Muncie. The class was chosen because the teacher desired to use the Frostig Program for the Development of Visual Perception in the classroom to see if the program would accomplish the results its authors claim it will accomplish. The children are placed in this class on the basis of recommendations by psychometrists. The pupils have intelligence quotient scores of fifty to seventy-nine and chronological ages of six years to nine years with mental ages of three years to seven years. At the time of testing, ages ranged from eight years to ten years and two months. The intelligence quotient scores ranged from fifty-four to seventy-eight.

The Measuring Instrument

The Marianne Frostig Developmental Test of Visual Perception (11) which was developed by Marianne Frostig, Phyllis Maslow, D. Welty Lefever, and John R. B. Whittlesey was used to determine the levels of development for each child before and after twelve school weeks of work with the Frostig Program for the Development of Visual Perception. The test was designed to explore the development of five areas of visual perception. The Standardization Manual (9, p.464)
lists these areas as eye-hand coordination, figure-ground perception, perception of form constancy, perception of position in space, and perception of spatial relationships. These areas are not believed by the authors of the test to be the only ones involved in the total process of visual perception, but they were conceived to be important parts of the process and seemed to have particular relevance to school performance. Therefore, they were studied.

The test consists of five subtests covering the five areas of visual perception mentioned above. Frostig describes these subtest areas in the Administration and Scoring Manual (10, p. 5)

I. Eye-hand coordination — The child's task here is to draw straight and curved lines between increasingly narrow boundaries.

II. Figure-ground perception — Here the child is asked to discriminate between intersecting figures.

III. Perception of form constancy — The task is to detect squares and circles among other shapes on the page.

IV. Perception of position in space — This is tested by requiring the child to detect a reversed or rotated figure in a sequence.

V. Perception of spatial relationships — The task is to copy patterns by linking dots.

The test can be given to a group or an individual. In the present study, all tests were given individually.
Standardization

For the 1963 standardization, The Developmental Test of Visual Perception was administered to 2100 nursery school and public school children between the ages of three and nine years. The age groups ranged from 107 children of three to three and one-half years old to 240 six and one-half to seven years old. The schools from which the samples were obtained were selected for three main considerations. The first consideration was the attempt to get a stratified socio-economic sample of children. The second was the willingness of the schools to cooperate. The third was the proximity to the research center. The authors recognize that the sample is far from perfect because it is geographically and socio-economically deficient since it was drawn from a restricted area and information on the socio-economic status of the children was not available.

From this standardization a perceptual age level for each subtest was determined. This is defined in terms of the performance of the average child in the corresponding age group. For example, a child obtaining a raw score of ten on the eye-hand subtest would be performing at the same level as the average child of five years three months. This information can be obtained from Table 1 of the Administration and Scoring Manual.

Reliability

After a three week interval, reliability as determined by the test-retest method used on a sample of fifty children in 1960 was 0.98 using the full range in ages (9, pp.488-490). However, the group was small and tests were administered by the same trained psychologist.
In 1962, test-retest reliability was also determined when the instrument was used by people trained in giving the Frostig test, but who were not psychologists or psychometrists. Fifty-five kindergarten and seventy-two first grade children were tested and then retested after fourteen days. Correlations for both groups were 0.69 for the total scores. Correlations ranged from a low of 0.33 in the kindergarten eye-motor coordination subtest to a high of 0.83 in the kindergarten perception of form constancy.

Split-half reliability correlation coefficients for the total test decrease slightly with increasing age. These correlations ranged from 0.75 for 275 children eight and nine years old to 0.89 for 364 children five and six years old.

Validity

When classroom adjustment as determined by teachers' ratings was compared with the Frostig test, a correlation of 0.441 was found for a group of 374 kindergarten children (9, pp. 492-497). Also, a correlation of 0.502 was found with motor coordination. A correlation of 0.497 was found between the Frostig test and intellectual functioning for a group of 304 kindergarten children.

The Goodenough test which may be used as an indicator of intellectual functioning, of perceptual development, and as projective technique was compared with the Frostig test in 1961. Product-moment correlations of 0.460 for kindergarten children, of 0.318 for first grade children, and of 0.366 for second grade
children were found. The relatively low correlations show the two tests measure relatively distinct factors, but ones that in some degree overlap.

A group of twenty-five children who were four and one-half to six and one-half years of age and who were enrolled in the kindergarten of University Elementary School, University of California, Los Angeles, California, were exposed to reading materials but not forced to use them. Eight of the children were diagnosed by the Frostig test to be in the twenty-fifth percentile or below. It was predicted these children would not learn to read, and after six months, only one had learned to read while only one of the children from the group above the twenty-fifth percentile had not learned to read.

Also, a pilot training project was conducted in 1962 to assess methods of alleviating difficulties caused by faulty visual perception. The forty-two children in the South School kindergarten were paired according to the Frostig test scores, and one of each pair was selected for training by flipping a coin. The experimental group had eight children with scores below the twenty-fifth percentile and six above it. Upon retesting, all of the experimental children scored at or above the twenty-fifth percentile (one girl scored at the twenty-fifth percentile). However, four of the control group fell below the twenty-fifth percentile.
Method of Testing

The pre-tests and post-tests were administered individually to the subjects during a one week period. Directions were taken verbatim from the Administration and Scoring Manual. The test was referred to as a series of games the child was going to play. Scoring of the tests is highly objective and is also described in the manual. Most of the possibilities are described and directions for scoring are quite clear and precise.

A Perceptual Age Score which is defined in terms of the performance of the average child in the corresponding age group can be found for each subtest. This information is found in Table 1 of the Administration and Scoring Manual. The child's raw score is found on the table with the scores Perceptual Age Equivalent.

Scale Scores derived by dividing the Perceptual Age by the Chronological Age and multiplying by ten can be found.

Perceptual Quotients can also be found. This is a deviation score obtained from the sum of the subtest scale scores after correction for age variation.

The manual states that Scale Scores and Perceptual Quotients need not be computed for children ten years of age or above who do not receive the maximum Perceptual Age equivalent for any subtest. Since several of the children were ten or above, the only scores used for comparison in the study were the Perceptual Age Scores.

Improvement was based on an increase in the Perceptual Age scores.
The Teaching Program

The Frostig Program for the Development of Visual Perception was used by the classroom teacher after the initial testing by this author in September 1966. The use of the material was continued until the retesting in January 1967. The order of work was decided upon by the teacher to meet the needs of the children as the teacher saw them. Work was done in all five of the areas tested but not necessarily equally timewise. The Teacher's Guide leaves the decision for the order of training to the teacher, but does state that the worksheets for the five areas should be used concurrently. Worksheets for various subareas are numbered in a suggested order of difficulty and should be used in that order with little variation. It is also important to begin at an easy level to insure success, and the degrees of difficulty should allow the children to progress comfortably.

The five main areas have worksheets for different subareas. Visual-Motor Coordination has sections for (1) drawing with guidelines where the paths for drawing become progressively narrow and complex, (2) tracing along broken lines, (3) drawing without guidelines, and (4) coloring within boundaries.

In the Figure-Ground Perception area, there are subareas using (1) intersecting lines and following only the correct line, (2) intersecting figures where figures are discriminated, (3) hidden figures in pictures, (4) overlapping figures, (5) figure completion where parts of the figure are missing, (6) figure assembly,
(7) similarities and differences of details, and (8) reversal of figure-ground.

In the Perceptual Constancy area, the worksheets are on shape constancy and size constancy.

For Position in Space, the exercises are on (1) reversals and rotations — whole figures, (2) position of details, and (3) mirror patterns.

For Spatial Relationships, the subareas are (1) related positions of two objects, (2) similarities and differences, (3) shortest path to a goal, (4) figure completion, (5) connecting dots, (6) recall of motor sequences, (7) spatial sequences, and (8) assembly of parts.

From the different areas, the classroom teacher chose the exercises she felt best pertained to her class. An exercise was given each day, and all the children did the same exercise.

Statistical Analysis

After each testing, Perceptual Age Equivalents for the five subareas were found for each child. (See Table 1.) These Perceptual Age Equivalents were compared for each child to find improvement made since the initial testing. Graphs of individual scores were made to illustrate this improvement. (See Figures 1 to 15).

Percentage of change was found for the group. Each of the fifteen subjects was tested in five subareas making a total of seventy-five possible areas of change for the group.
In order to find any significant difference between the groups compared in Hypotheses II, III, and IV, the Mann-Whitney \( U \) Test of Significance, as explained by Siegel (16, pp. 116-127), was used. If the groups could not be found to be significantly different, they could not be compared. If the groups were without significant difference, they would be assumed to be from like populations and would not have responded differently to the training problem. Appendix A shows the results of this test of significance.

Where a significant difference was found, the groups were further studied to locate the differences in abilities.
TABLE 1

TEST (T) AND RETEST (R) SCORES OF SUBJECTS
(Expressed in years and months)

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<thead>
<tr>
<th>Subjects</th>
<th>Eye-Motor</th>
<th>Figure-Ground</th>
<th>Form Constancy</th>
<th>Position in Space</th>
<th>Spatial Relation</th>
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\[ G = \text{Number of areas where gains were made.} \]

\[ L = \text{Number of areas where losses were made.} \]

\[ S = \text{Number of areas where scores remained the same.} \]
Subject A is a female with an intelligence quotient of sixty-one. Her chronological ages were ten years, one month and ten years, five months when testing and retesting took place. She had attended five years of public school including one year of kindergarten before attending the special class for the first time this year.
Subject B is a male with an intelligence quotient of fifty-five. His chronological ages were ten years, two months and ten years, six months when testing and retesting took place. He had attended three years of kindergarten before entering the special class. He is now in his second year at the school. He is diagnosed as having brain injury due to meningitis.
Subject C is a male with an intelligence quotient of sixty. His chronological ages were nine years, seven months and nine years, eleven months when testing and retesting took place. He had attended no public school before the special school and is now in his second year in that school. Medical records show that he has a brain tumor.
Subject D is a male with an intelligence quotient of sixty-seven. His chronological ages were nine years, zero months and nine years, four months when testing and retesting took place. He had attended three years of public school including one year of kindergarten and is in his second year of special education.
Subject E is a female with an intelligence quotient of sixty.
Her chronological ages were eight years, seven months and eight years, eleven months when testing and retesting took place. She had attended three years of public school including one year of kindergarten and is now in her first year at the special school.
Subject F is a male with an intelligence quotient of seventy-six. His chronological ages were nine years, nine months and ten years, one month when testing and retesting took place. He had attended one year of public school and had not attended kindergarten. He is in his first year of special schooling.
SUBJECT G

Subject G is a male with an intelligence quotient of sixty-three. His chronological ages were eight years, zero months and eight years, four months when testing and retesting took place. He had attended no public school before entering the special school this year. He is diagnosed as being mongoloid (Down's syndrome).
Subject H is a female with an intelligence quotient of fifty-four. Her chronological ages were nine years, three months and nine years, seven months when testing and retesting took place. She had attended three years of public school including two years of kindergarten and is in her second year at the special school. She is on medication for epilepsy.
Subject I is a female with an intelligence quotient of seventy-one. Her chronological ages were eight years, zero months and eight years, four months when testing and retesting took place. She had attended three years of public school including one year of kindergarten and is in her first year of special education.
SUBJECT J

Subject J is a female with an intelligence quotient of sixty-eight. Her chronological ages were eight years, six months and eight years, ten months when testing and retesting took place. She had attended three years of public school including two years of kindergarten and is now in her first year of special education. She has vision difficulties, and her broken glasses had not been replaced for either the test or retest.
Subject K is a female with an intelligence quotient of seventy-eight.* Her chronological ages were eight years, seven months and eight years, eleven months when testing and retesting took place. She had attended no public school before and is in her first year at the special education school.

This is the only score not determined by the Stanford Binet test. This score was determined by the Wechsler Performance Scale.

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*This is the only score not determined by the Stanford Binet test. This score was determined by the Wechsler Performance Scale.
Subject L is a female with an intelligence quotient of fifty-nine. Her chronological ages were nine years, zero months and nine years, four months when testing and retesting took place. She had attended two years of kindergarten before attending the special education class. She is in her second year in the school. She has vision difficulties and had just received new glasses before the retest.
Subject M is a female with an intelligence quotient of sixty-two. Her chronological ages were eight years, eight months and nine years, zero months when testing and retesting took place. She had attended two years of public school including one year of kindergarten and is in her first year of special education.
Subject N is a male with an intelligence quotient of sixty-seven. His chronological ages were nine years, three months and nine years, seven months when testing and retesting took place. He had attended four years of public school including two years of kindergarten and is in his second year of special education.
Subject 0 is a female with an intelligence quotient of sixty-eight. Her chronological ages were eight years, nine months and nine years, one month when testing and retesting took place. She had attended three years of public school including one year of kindergarten and is in her first year of special education.
CHAPTER III

RESULTS

Hypothesis I

After twelve weeks of training, primary, educable retarded children will show general improvement in the five areas of visual perception to be developed by the Frostig program.

The hypothesis was tested by analyzing the individual test and retest scores (See Table I). Of seventy-five subareas (fifteen subjects with five areas each), sixty-eight percent (N=51) showed an increase in Perceptual Age Score. All but one score increased six months or more. Since the re-test took place four months after the initial testing, a gain of three months could be attributed to normal development. Only one subject (Subject 0) showed a gain of three months. The other fifty gains ranged from six months to four years and nine months.

Sixteen percent (N=12) of the seventy-five subareas showed a decrease in Perceptual Age Score. These losses ranged from three months to one year and three months.

Another sixteen percent (N=12) of the subareas showed neither gain nor loss.

Since a much larger percentage (sixty-eight percent) of the subareas showed increased Perceptual Age Scores rather than decreased (twelve percent) or equal scores (twelve percent) following the training period, the first hypothesis is confirmed. Profiles
for individuals are shown in Figures 1 through 15 and descriptions of the subjects are given.

Hypothesis II

Children with previously determined intelligence quotients from sixty-six to seventy-nine will show a greater degree of improvement than will children with intelligence quotients of fifty to sixty-five.

To determine whether two groups have been drawn from the same or different populations, the Mann-Whitney "U" Test of Significance as explained by Siegel (16) was used for Hypotheses II, III, and IV. The level of significance was set at the five percent level. This non-parametric test was used because all assumptions necessary for using parametric statistics cannot be met. The groups compared cannot be assumed to be normally distributed. No assumptions are made about the population from which the groups were drawn. Siegel (16, p. 116) stated that the Mann-Whitney "U" Test is "an excellent alternative to the "t" test, and, of course, it does not have the restrictive assumptions and requirements associated with the "t" test.

Hypothesis II was tested with the Mann-Whitney "U" Test and a significant difference was shown in the figure-ground perception of the two groups. However, no significance was found in the sub-areas of eye-hand coordination, perception of form constancy, perception of position in space, or perception of spatial relationships.
Although significance was found in the figure-ground perception of the groups, the greatest improvement was shown by the fifty to sixty-five intelligence quotient group. Seven of the eight (eighty-seven percent) in this group improved in the figure-ground perception area. Only two of the seven (twenty-nine percent in the sixty-six to seventy-nine intelligence quotient group) showed improvement in this area.

Because four areas did not show any significant difference and the fifth area showed improvement in favor of the fifty to sixty-five intelligence quotient group, Hypothesis II was not confirmed.

**Hypothesis III**

Children who have previously attended classes for the educable mentally retarded will make more gains with this program than will the children who are attending the "educable" class for their first year.

The Mann-Whitney "U" Test was also used to determine significant difference between these two groups of children. The test showed that the two groups were significantly different and independent of one another on all five subtests. Progress was determined by the percentage of improved scores for each group.

In the eye-hand coordination subtest, the first year students showed greater improvement than the second year students. Seventy percent (N=7) of the first year students improved while only forty percent (N=4) of the second year students improved. The hypothesis that the second year students would make more gains than the first year students was not confirmed in this subtest.
In figure-ground perception, each group had sixty percent (N=6 for first year students and N=3 for second year students) improvement. Since the second year students did not show greater improvement, the hypothesis was again not confirmed.

In the perception of form constancy, seven of ten (seventy percent) of the first year students showed improvement while two of five (forty percent) of the second year students showed improvement. The first year students again showed greater improvement so the hypothesis was not confirmed.

Position in space perception was improved upon by both groups. However, again the group in their first year of special education showed greater gains. This group had ninety percent (N=9) of its members showing improvement. The group in their second year of special education had eighty percent (N=4) of its members showing gains. The hypothesis was not confirmed since the second year students did not show greater gains than the first year students showed.

In the perception of spatial relations, the hypothesis was not confirmed since the first year subjects had eighty percent (N=8) of its group showing improvement while sixty percent (N=3) of the second year subjects improved their scores.

Hypothesis IV

Girls in the study will show greater improvement as determined by the pre-training and the post-training test than will the boys in the study.
The Mann-Whitney "U" Test of significance was again used. All of the five areas showed a significant difference between the scores of the girls and the scores of the boys.

In the area of eye-motor coordination, the boys showed a greater percentage of improvement than did the girls. Eighty-three percent (N=5) of the boys had improved scores while only fifty-six percent (N=5) of the girls had improved scores. The hypothesis was not confirmed in this area since the girls did not show greater improvement than the boys did.

The hypothesis was confirmed in the area of figure-ground perception because the girls did show a greater percentage of improvement than did the boys. Sixty-seven percent (N=6) of the girls showed improvement while only thirty-three percent (N=2) of the boys showed improvement.

In the area of perception of form constancy, the hypothesis was again confirmed. Sixty-seven percent (N=6) of the girls showed gains while fifty percent (N=3) of the boys showed gains.

Eighty-nine percent (N=3) of the girls showed a gain in the area of perception of position in space while eighty-three percent (N=5) of the boys showed gains. Therefore, the hypothesis was again confirmed.

In the area of perception of spatial relationships, the hypothesis was not confirmed. Sixty-seven percent (N=6) of the girls showed gains while eighty-three percent (N=5) of the boys showed gains.
Discussion of Results

From analysis of the data, the Frostig Program for the Development of Visual Perception does appear to have a positive effect on the scores obtained by the primary, educable retarded subjects tested. All did show gains in at least two subareas tested. Fifty-one gains were shown in the seventy-five subareas of the entire group. Since only one of these gains was three months while the testing period consisted of twelve school weeks, the other fifty gains are probably not attributable to "normal" development and thus would be attributed to development by the Frostig program.

Since only one distinct difference in the five subareas could be found when the subjects were grouped according to intelligence quotient ranges of fifty to sixty-five and of sixty-six to eighty, the actual intelligence quotient of the primary, educable child does not seem to be a very important factor in responsiveness of the subject to this visual-perceptual training program. In the subarea that did show significance (the figure-ground perception subarea), the lower IQ group showed much greater improvement than the higher group. Seven of the eight (eighty-eight percent) of the lower IQ group improved as compared to two of seven (twenty-nine percent) of the higher group.

Children in their first year of special education also constituted a significantly different group than the children in their second year of special education. This was true in all five areas. The first year subjects made greater gains in four of the five
subareas tested (eye-hand coordination, form constancy, position in space, spatial relationships) when compared to the second year special education subjects. In the fifth area (figure-ground perception), they made equal gains (sixty percent each). The first year special education subjects did seem to benefit more from the Frostig Perceptual Development Program than did the second year subjects. However, since the second year subjects did show improvement from forty percent to eighty percent in all areas, they, too, benefited from the program.

The scores of girls were also found to compose a distinctly different group when compared to the scores of the boys. This was true in all five subareas. The girls showed greater improvement in figure-ground perception, form constancy, and position in space when compared to the boys. The boys made greater gains in eye-motor coordination and spatial relations than did the girls. However, since both groups made improvement, the training was of value to both boys and girls.
CHAPTER IV
IMPlications

Theoretical Implications

The information from the test results points to much improvement in visual perception by the educable, mentally retarded subjects. The Frostig materials do appear to have increased the awareness of the subjects in the area of visual perception. The results, therefore, might be construed as an indication of the value of visual-perceptual training for the educable mentally retarded.

If educable retardates can be made more aware of the things they see, they may become better adjusted to their environments at home and at work. The training necessary may not be wholly based on the Frostig material, however. If educators are made aware of the value of developing the visual perception of these educable children, they can devise their own materials or situations for fulfilling the needs of their own pupils and problems.

The results also found no appreciable difference in the higher (IQ scores of sixty-six to seventy-nine) range and the lower (IQ scores of fifty to sixty-five) range of the educables studied. It would, therefore, appear that these groups can be taught as one in the development of visual perception. There did not appear to be any need for separating the ranges or for specializing the materials used. The individuals may require extra attention and materials, but the special needs cannot be based on the intellectual standing of the educable in his class.
The findings also showed that the children in their first year of special education showed greater improvement as a result of training. It seems the students who were in their second year of special education had previously made gains and were near their maximum level of achievement. From these facts, educators can expect to see small gains in the levels of the students who have nearly reached their maximum. Great improvement may be shown by students who are new to the special education techniques but cannot be expected to appear in the work of the other special education students. However, it must be recalled that all the children did show gains in their visual perception levels so gains will be made, but they will probably not be spectacular.

The findings also pointed out significant differences in the improvement of the scores of the group of girls and the scores of the group of boys. In some areas the girls' achievements exceeded those of the boys. These were figure-ground perception, form constancy, and position in space. The boys exceeded the improvement of the girls in eye-motor coordination and perception of spacial relationships. From this information, an educator could plan a training program that would work toward strengthening the weaker areas. Since all subjects did show some improvement from work planned for the whole class, the general training does appear to benefit both male and female.

Practical Implications

The results of this study appear to warrant the development of visual perception. The educable mentally retarded children did make
gains in their tested visual perception. It would seem that this type of training is suitable to the levels of the educable children since all did have some areas that were improved.

Also, the comparison of the scores of the lower range (IQ fifty to sixty-five) of the educables with the upper range (IQ sixty-six to seventy-nine) does not necessitate the division of the educable class into these groups. All the children improved but the group could not be separated as to the degree of improvement.

Since the subjects in their second year of special education showed a lesser degree of improvement than the first year special education subjects, the classroom teacher must expect this "lesser" degree of improvement with most children. There will probably be advancement, but it may be small. Therefore, educators must expect this lesser degree of improvement and not expect miraculous changes.

Because the girls and the boys showed different amounts of achievement in the areas tested, it might be expected that these groups will require some amount of specialized training. If strengths and weaknesses can be determined, these should be taken into account when the planning of the program is being done. This study would suggest that the girls be given some extra training in eye-motor coordination and spatial relationships. The boys might need additional training in figure-ground perception, form constancy, and position in space. Since the general program did show improvement for all, this training would probably be in addition to the general training that would be used for all the students.
CHAPTER V

CONCLUSIONS

The Findings

The Marianne Frostig Program for the Development of Visual Perception was found to have a positive effect on a group of primary, educable retarded children. Eye-hand coordination, figure-ground perception, perception of form constancy, perception of position in space, and perception of spatial relationships improved after work with this program.

All of the subjects showed improvement in at least two of the five areas tested. This improvement was above that which would be considered normal development.

The group with intelligence quotients between fifty and sixty-five could not be differentiated from the group with intelligence quotients between sixty-six and seventy-nine. The estimated intellectual level of the child then would not be an accurate predictor of the child's capabilities in the development of visual perception—at least when the child was an educable mentally retarded child.

The first year special education students did make greater gains than did the second year students. More improvement can be expected from those who are beginning to attain their potential through special education techniques than from those who have previously neared their maximum level of performance. The gains will probably be small but will be present.
Differences were also shown when the male subjects were compared with the female subjects. Since the groups showed significant differences in retest, weaknesses and strengths of the groups may be different. However, one group did not prove to be more responsive to the training than the other group.

Limitations of the Study

The test for the development of visual perception was standardized on a group of middle class children in the California area. The subjects of the present study were not from the middle class. Also, the standardization was on children who were not considered mentally retarded. The estimated abilities are then those for normal children. The subjects of this study were all legally described as mentally retarded. The standardization group does not closely match the group tested for this project.

No information regarding general carry-over of the training in visual perception to areas other than the ones tested by the Frostig test could be found. The actual worth of this program is, therefore, difficult to determine.

The Marianne Frostig Program for the Development of Visual Perception is set up much the same way as the test. The test booklet (see Appendix B) has the same kind of situations as the program. Therefore, the program gave practice in working the types of problems found in the Frostig test. For instance, the children were given practice in finding the same type of objects in the program as they
were to find in the test booklet. This practice could tend to inflate the scores when the subjects are retested.

The period of twelve school weeks for the use of the Frostig Program for the Development of Visual Perception was short, and more accurate results could possibly be determined if the training period were extended.

The study was made on a limited group, and no control group was used or available. Had a control group been used, the results should have been more reliable. Maturation could possibly be responsible for the gains showed by the subjects. A control group should have been able to establish the amount of improvement due to maturation.

The examiner of these children became their student teacher after the initial test and before the final test. She did not do any of the work with the Frostig program, but the examiner-examinee relationship could have some bearing (either positive or negative) on the scores of the retests of the subjects. The effect the situation had on the subjects cannot be determined.

Recommendations for Further Research

Standardization of the Frostig Developmental Test of Visual Perception using educable retardates would give a much more true picture of what can be expected of that group of subjects. Such a study might point out the weaknesses of this group, and therefore, enable educators to use the Frostig materials more effectively.
A study of the carry-over of visual-perceptual training into other areas of visual perception might show the actual value of this program. Also, the same areas developed by the program could be tested when presented in situations that are different from those presented by the Frostig materials. Unfamiliar tasks might show the amount of carry-over in the areas that have been developed. They might also help to determine if inflation of test scores due to practice is probable.

Use of a matched control group which would receive no structured training in visual perception should determine the amount of gain that could be expected to occur due to maturation. A control group would give a more reliable basis for deciding the value of visual-perceptual training than a study without a control group can do.

Studies on the carry-over of the development of visual perception into other areas of perception such as auditory and tactile perception might show whether the training is also developing the general awareness of the subjects.
BIBLIOGRAPHY


APPENDIX A
### MANN-WHITNEY "U" DATA

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The smallest value of "U" in each subtest must be 10 or above to be significant. (16)

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To be significant the probability of occurrence (p) must be 0.050 or less. (3)

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The smallest value of "U" in each subtest must be greater than 8 to be significant. (16)
APPENDIX B
Marianne Frostig

DEVELOPMENTAL TEST OF VISUAL PERCEPTION

In collaboration with: Welty Lefever, Ph.D. and John R. B. Whittlesey, M.S.

CONSULTING PSYCHOLOGISTS PRESS 577 COLLEGE AVENUE, PALO ALTO, CALIFORNIA
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