The Teaching of Concrete Thinking Strategies to Five-Year-Old Children and its Effect on Performance on the Bender-Gestalt Test

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THE TEACHING OF CONCRETE THINKING STRATEGIES TO FIVE-YEAR-OLD CHILDREN AND ITS EFFECT ON PERFORMANCE ON THE BENDER-GESTALT TEST

by

Ronald C. Bennett

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Psychology

Approved:

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Logan, Utah
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Ronald C. Bennett
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ABSTRACT
The Teaching of Concrete Thinking Strategies to Five-Year-Old Children and its Effect on Performance on the Bender-Gestalt Test

by
Ronald C. Bennett, Master of Science
Utah State University, 1970

Major Professor: Dr. Arden Frandsen
Department: Psychology

This study was designed to examine the effect teaching five and one-half to six-year-old children analytical and conceptual thinking strategies would have on their subsequent performance on the Bender-Gestalt Test. The sample was composed of 34 kindergarten children in this age range from the Providence Elementary School. They were randomly divided into two groups of equal size; one group was then given three 10-minute training sessions over three days which were designed to teach them analytical and conceptual thinking strategies. The other group was also given three 10-minute sessions with the investigator; however, they were only involved in looking at and identifying pictures.

The hypothesis that the group receiving this training would have lower error scores on the Bender-Gestalt Test was not substantiated by this research.

One possible explanation for these results is that the training given was not extensive enough to effectively teach the use of these concepts as measured by their test performance.

(42 pages)
INTRODUCTION

The purpose of this study was to investigate the effects of teaching concrete thinking strategies to children who are in the perceptual intuitive or preoperational stage of mental development. The Bender-Gestalt Test was used to measure this effect because the errors that result from immaturity in the mental development of young children could result from their unanalytical perceptual thinking. Conceptual thinking should avoid these errors.

The geometric figures utilized on this test are made up of lines, angles, curves, and dots combined in a variety of relationships. Individuals see and reproduce these geometrical designs differently. The nine geometric figures that comprise the Bender-Gestalt Test were taken from a larger sample of figures developed by Wertheimer (Hutt and Briskine, 1960, p. 167), who use them to study Gestalt principles involved in perception. According to the Gestalt School, the integration of three factors are necessary for mature perception: (1) "the innate tendency of organisms to organize perceptual data as it is affected by (2) temporal factors and (3) maturational level." Perceptual abilities are determined by biological factors and, therefore, are fully developed only when the organism has reached the critical point of maturation.

Koppitz (1964), in her scoring system for the Bender-Gestalt Test, attributes errors committed by young children below the age of seven to immaturity in visual-motor perception; or if there are enough significant errors present, to a malfunctioning in visual-motor perception. The following errors are considered significant indicators of immaturity
in visual motor functioning for children below six years of age.\(^1\) extra or missing angles (Figures A and 7), angles for curves (Figure 6), straight line for curves (Figure 6), rotation of design by 45 degrees (Figures A, 1, 4, 5, and 8), failure to integrate parts (Figures A, 4, and 6), and shape of design lost (Figure 3). Pascal and Suttell (1951) included the following significant errors:\(^2\) number of dots or circles (Figures 1, 2, 3, 4, and 5), number of columns or rows (Figures 2 and 3), and parts of the design missing (Figures 2, 3, 4, 5, and 8).

Jean Piaget's Theory of Development (Frandsen, 1967) indicates that the mental operations that a child needs to perform accurately on the tasks mentioned above are not fully developed during the preoperational or preconceptual stage (two to six or seven years) of development. At the perceptual-intuitive level of learning (four to six or seven years), according to this theory, the child's interpretation of the quantity and arrangement of stimuli in space is based on perceptual-intuitive judgments of the unanalyzed way things look, rather than logically reasoned steps. The child at this level of development does not have well-structured concepts of concrete things, nor does he have adequate thinking processes to demonstrate these concepts operationally. He does not see part-whole relationships; and because of this, his operations are based on shrewd guesses and his perception of the situation as a whole. In addition, he does not use other thinking strategies such as conservation of numerical correspondence, conceptualizing the total class when only its subdivisions are perceived; and he is influenced by only one dimension of mass and space.

\(^1\) Figures referred to may be found on pages 22-26.

\(^2\) Figures referred to may be found on pages 27-30.
Problem Statement

The problem is that the child four to six or seven years of age may make errors indicative of immaturity in visual-motor perception or of preconceptual thinking because he has not acquired the concrete mental operations necessary to avoid making these errors.
Koppitz (1960) conducted a normative study on the Bender-Gestalt Test using 1,055 school children from 11 schools located in various urban, suburban, small town, and rural areas. Her sample consisted of both colored and white children ranging in age from five years to 10 years five months. The Bender-Gestalt Test was administered to each child individually. She found a consistent decrease in error score with increased age. A marked decrease in scores occurred on the test protocols of subjects (Ss) between the ages of five and seven years, with a more gradual decrease in scores thereafter to age nine years. The author reported that this instrument accurately indicates outstanding and immature visual-motor functioning in children up to eight years of age. After eight years of age, it no longer differentiates outstanding visual motor functioning, as many children then have sufficient maturity of visual-motor perception to draw the geometric designs with very few distortions.

Fabian (1945) also found a developmental phenomenon in which the number of rotations decreases as the child matures and disappears at about eight years of age. He utilized 586 public school children in New York City ranging from five years to nine years of age. The Bender-Gestalt Test was administered to each S individually. The rotation of Gestalt figures was found to occur frequently in pre-school and first-grade children, with a significant drop in the number of rotations between six and one-half years and seven and one-half years of age. Sixty-three percent of the Ss between five and six years of
age rotated 82 percent of the figures, 52 percent of the children between six and six and one-half years of age rotated 73 percent of the figures, and 21 percent of the Ss between six and one-half and seven years of age rotated 79 percent of the figures.

Lackman (1960) was able to differentiate along a chronological age continuum using Ss ranging in age from eight years to 11 years 11 months. He hypothesized that perceptual-motor functioning as operationally defined by Bender-Gestalt Protocols involves the expression of what is perceived, as well as visual perception. Bender-Gestalt protocols express the quality of perception, the motor impulsivity, and an attempt at its control. These three factors are considered inseparable; therefore, if reading disability indicated immaturity in perceptual-motor development, then retarded readers should show more immature functioning on the Bender-Gestalt test than a comparable group of normal readers and less mature performance than emotionally disturbed children who have normal reading ability. To investigate this problem, Lackman (1960) equated three groups of 40 children: a group of emotionally disturbed, but normal, readers; a group of normal Ss who were retarded readers; and a normal group. All three groups ranged in age from eight years to 11 years 11 months, and were equated for age, sex, and I.Q. The Bender-Gestalt was administered to each S individually and scored according to distortions defined by Bender (Koppitz, 1964) and Pascal and Suttell (1951). The occurrence of the following errors was scored: angulation, rotation, primitivation, separation, and slant. Significant effects were not found in any of the interactions, nor were there any patterns of types of distortions as a function of age, or of diagnostic group, or of age and diagnostic group.
Bender-Gestalt protocols did distinguish children with reading disabilities from normal children, and the emotionally disturbed group had a high incidence of distortions, but the difference was not significant.

Koppitz (1958a), using younger children to study the usefulness of the Bender-Gestalt test in identifying learning disturbances due to problems in visual-motor perception and in differentiating children above and below average in reading, writing, and spelling, found that some types of errors were related to learning disturbances. Two groups of children were selected. Group I was selected on the basis of achievement and adjustment according to their teacher's evaluation. Forty-one Ss were rated above average and 36 below average on these two criteria. Group II consisted of 20 children referred to the Children's Mental Health Center as a result of poor school progress and 31 children referred to the same institution because of emotional problems.

The Bender test was administered to each S individually and scored on seven items adapted from Pascal and Suttell's (1951) scoring scheme. Composite scores were computed for each S in each group and comparisons of good and poor students, whose scores were above or below the group mean, were made using Chi-squares. Results indicating that good students tend to have lower composite scores than do poor students were significant. However, among children under six years of age there was very little relationship found between school achievement and the ability to draw a straight line, the omission of parts of a figure, and the addition of dots on Figure 3 (see page 24). These errors were found equally among good and poor students before age six, but decreased as the Ss grew older. The inability to control lines directionally and in shape (rotation, drawing angles) was definitely
related to learning disturbances. Because these deviations most often occurred with young children or psychotics, the author hypothesized that they were due to immaturity and/or loss of control due to confusion or regression. The following errors were also found indicative of immaturity in younger children: inability to integrate parts into wholes, inability to control and terminate visual-motor activity, and failure to integrate the parts of figures.

Harriman and Harriman (1950) explored the hypothesis that satisfactory reading progress is related to a maturational level where sensory-perceptual-motor activity more closely resembles that of an adult than that of pre-readers. Thirty children in the Pennsylvania State College Nursery School who had not begun to read and a random selection of 30 second-grade children from State College, Pennsylvania, were used for this study. Both groups were administered the Bender-Gestalt Test and scored according to the categories outlined by Hutt and Briskine (1960) as follows: order, expansion, use of margin, size reduction, condensation and simplification, angulation, curvature, modification, perseverations, closure effects, overlapping, and elaboration. Pre-readers were less inclined to reduce the size of the designs; however, all of the pre-readers made errors on horizontal-vertical orientation, while only half of the readers committed this error. Perseveration, overlapping of figures, and the tendency to introduce syncretistic elements occurred more frequently in pre-reader protocols than in reader test protocols. The Bender-Gestalt scores revealed significantly valid differentiations between the two groups. The author concluded that although the task-oriented responses may be partially due to school training, the Bender-Gestalt Test may still be used as a measure of school readiness.
Baldwin (1950) does not think Harriman and Harriman's (1950) suggestions are defensible; he says that although the visual-motor Gestalt function may be one index of reading readiness, no causal relationship can be assumed on the basis of the Harriman study. Their data, he reports, reveals no closer relationship between visual-motor performance and school readiness than that they are both manifestations of the developmental process. To illustrate the danger of overestimating the ability of the Bender-Gestalt Test to differentiate between children in reading readiness, he cites a case of two mentally retarded sisters, in which the more retarded girl, who had the more immature Bender protocol, scored higher on a reading test than her sister, whose Bender resembled the adult type. He concluded that factors which may compensate for inadequate visual-motor Gestalt functioning must be considered.

Koppitz (1958b) conducted a study to investigate the relationship between performance on the Bender-Gestalt Test and intelligence as measured by the Wechsler Intelligence Scoring Criterion (WISC). She utilized 90 elementary school children, ranging in age from six years seven months to 11 years seven months, who had been referred either because of behavior problems or because of learning problems. All Ss were administered the WISC and Bender tests in the same session. The test protocols were then scored according to the standardized procedure, using the Wechsler or Koppitz scoring criterion, and evaluated on the basis of the age norms for each child. The test scores of the learning problem group were then compared to those of the behavior problem group. A significant relationship was found between learning problems, Bender-Gestalt protocols, and Performance I.Q.'s in the first and second grades. However, Wechsler's full scale I.Q. did not show a strong
relationship, and the verbal I.Q.'s showed no significant relationship at these levels. At the third and fourth-grade levels, verbal I.Q.'s, performance I.Q.'s, full scale I.Q.'s, and Bender protocols were significantly related to learning problems and were all significantly related to Bender-Gestalt scores. The findings of this study suggest that immaturity in visual-motor perception may be closely associated with learning problems in the first two grades.

Krop and Smith (1969) have investigated the effect participating in educational classes and special instructions in drawing geometric designs have on Bender-Gestalt performance in mentally retarded subjects. Sixty retarded adult females were divided into two groups with respect to mental age (Stanford Binet), chronological age, years of school, and years in an institution. The group designated as Schooling was given six weeks of educational training and then randomly divided into two groups of 15 subjects. These groups were designated Special Schooling and General Schooling. Both schooling groups were given 12 weeks of education in which they studied language development, self-help skills, arithmetic and social skills, and socialization and motor development. Each subject was allowed to progress at her own speed. The Special Schooling group was given 30 minutes of special instructions each day for six weeks in the drawing of geometric figures. They were taught to name geometric designs and to differentiate between designs emphasizing accuracy, neatness, and differentiating between designs. The control group remained involved in its regular institutional program for the 12 weeks of the study.

All subjects were administered the Bender-Gestalt Test at the beginning of the study, after the first six weeks, and at the end of
the study. The Hanberg-Bender scoring system was used for evaluation. The following is a sample of the scoring system criterion: rotation (30 degrees or more), perseveration, restrain (figure omitted), tangency (curve and adjacent corner more than 1/8 inch apart), overlap (curve overlaps adjoining figure by more than 1/8 inch), erasures, disproportion between size of figures, and distortion of shape. An analysis of the school group protocols showed less perseveration, better discrimination between circles and dots; but no change in the number of rotation. Analysis of covariance on the Bender-Gestalt scores for the control and school groups between the first and second testing sessions was significant at the .005 confidence level.

The results of this study indicate that participation in an education program significantly improves (.01 confidence level) the performance of mentally retarded patients on the Bender-Gestalt Test and that additional improvement (.05 confidence level) is made with special instructions in the drawing of geometric designs.

**Piaget's Stages of Development**

Stearns and Borkowski (1969) have examined Piaget's stages of development to confirm the presence of stages in development of conservation and to investigate the relationship between mental age and chronological age to these stages. They also investigated the process of learning the concepts of horizontal and vertical orientation. The Ss for this study were 116 mentally retarded patients from the Apple Creek Hospital in northeastern Ohio. They were divided into four groups on the basis of mental age, as follows: group I, mental age 4 to 5.6; group II, mental age 5.7 to 7.0; group III, mental age 7.1 to 8.6; group IV, mental age 8.7 to 11.6.
Four conservation tasks were given to each S individually, on one session. The first task was for the S to use conservation when a row of 10 red blocks were spread into a longer line than 10 blue blocks, when 10 red blocks were pushed into a shorter line than 10 blue blocks, and when the 10 red blocks were "bunched" together. Each of the above comparisons was preceded by a demonstration of one-to-one correspondence between the rows of blocks. The second and third tasks were conducted using glasses of different shapes with the same amount of water or marbles in them. After each judgment by a S, the contents of the glass were poured back into a container like the comparison container to illustrate the continuing equality of amounts. The fourth and fifth tasks concerned the concepts of horizontal and vertical orientation. The vertical task was to draw figures, on a line drawing of a mountain, with crayons. The horizontal concept was studied by giving the S a series of outline drawings of bottles, one at a time, in different positions. The S was to draw a line indicating the position of colored water when a bottle was in a given position. A bottle with water in it was shown to the S after each response. These investigators found that as mental age increased, the number of Ss not demonstrating conservation decreased, reaching 0 percent in group IV. The correlation between mental age and conservation scores was .70 and the horizontal-vertical scores correlated .71 with mental age. Very few conservation scores were found in group I or group II (mental ages 4.0 to 5.6 and 5.7 to 7.0), supporting Piaget's theory with regard to the development sequence of conservation of equivalence as extended to the mentally retarded.

Dodwell (1963) conducted a study on the kinds of concepts and their development, as reported by Piaget and his associates. He examined the trends of different operations at various ages and stages of development.
He assessed these factors as evidence for a theory of cognitive development based on the development of operational groupings and progression topological to Euclidean spatial concepts. He used 194 public school children ranging in age from five years one month to 11 years three months. The Ss were drawn from all socioeconomic levels and had I.Q.'s ranging from 80 to 136 as measured on a group test. The test used for this study consisted of 34 items divided into seven subgroups, as follows:

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Name</th>
<th>Materials and/or Methods</th>
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<tbody>
<tr>
<td>I</td>
<td>Construction of Straight Line</td>
<td>&quot;Telegraph Poles&quot;</td>
</tr>
<tr>
<td>II</td>
<td>Drawing shapes</td>
<td>Pencil and paper, shapes to copy</td>
</tr>
<tr>
<td>III</td>
<td>Plane figures, lines, points, and continuity</td>
<td>Pencil &amp; paper, demonstration by tester</td>
</tr>
<tr>
<td>IV</td>
<td>Horizontal &amp; vertical coordinates</td>
<td>Bottles, &quot;boat&quot;, plumb-line, pictures</td>
</tr>
<tr>
<td>V</td>
<td>Geometrical sections</td>
<td>Plasticine solid geometrical models, sections to be drawn</td>
</tr>
<tr>
<td>VI</td>
<td>Similarity &amp; proportion</td>
<td>Shapes, similar shapes to be drawn around them, by parallel lines</td>
</tr>
<tr>
<td>VII</td>
<td>Coordination of perspective</td>
<td>Table model with mountains, pictures of &quot;points of view&quot; (Dodwell, 1963, p. 144)</td>
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</table>

Each S was administered the test individually in a standardized order of presentation and scored according to "standardized scoring procedure."

The results of this study were consistent with Piaget's views on development of spatial concepts. It was not, however, possible to determine any child's stage of development from the types of spatial concepts used, or the correctness of his answers within a particular conceptual framework. The ability to deal with spatial concepts improved with age, but no clear progression from one type of thinking about space to another was identifiable from the data.
SUMMARY OF REVIEW

This review indicates that:

1. There is a developmental phenomenon in which the number of errors committed on the Bender-Gestalt Test decreases with age. There is a marked decrease in error score between the age of five years and seven years six months, with a more gradual decrease thereafter to the age of nine years. However, it is not possible to determine any child's stage of development from the types of spatial concepts used.

2. Good students tend to have lower error scores than do poor students. In children over eight years old, there were no patterns of type of distortions as a function of age or of diagnostic group (emotionally disturbed, but normal readers; normals, but retarded readers; and a normal group). However, Bender-Gestalt protocols did distinguish children with reading disabilities from normal children. Because of increased maturity in visual-motor perception, the Bender-Gestalt Test does not differentiate outstanding visual motor functioning in children over eight years of age.

3. Task-oriented responses on the Bender-Gestalt Test may be partially due to school training, although this assumption is contested by Baldwin (1950). Pre-readers are less inclined to reduce the size of the design than are readers, but almost all make errors on horizontal-vertical orientation. In addition, perseveration, overlapping of figures, and the tendency to introduce syncretistic elements occur more frequently in pre-reader protocols than in readers test protocols.
4. Immaturity in visual-motor perception may be closely associated with learning problems in the first two grades. However, among children under six years of age there is very little relationship between school achievement and the ability to draw a straight line, the omission of parts of a figure, and the addition of dots on Figure 3 (see page 24). The inability to control lines directionally and in shape, however, were definitely related to learning disturbances. There is a significant relationship between learning problems and performance I.Q.'s (WISC) in the first and second grades. However, verbal I.Q.'s and full scale I.Q.'s indicate no significant relationship to learning problems at these levels. At the third and fourth grade levels, verbal I.Q.'s, performance I.Q.'s, and Bender protocols are significantly related to learning problems, and all are significantly related to Bender-Gestalt scores.

5. Participation in an education program significantly improves the performance of mentally retarded students on the Bender-Gestalt Test and additional improvement is made with special instructions in the drawing of geometric designs. Very few conservation scores were found before the age of seven years in the mentally retarded, supporting Piaget's theory with regard to the developmental sequence of conservation of equivalence as extended to the mentally retarded.
HYPOTHESIS

The children in the experimental group who have been taught to use analytical and conceptual thinking strategies will have lower error scores on the Bender-Gestalt Test than those children in the control group who have not been given this training.
PROCEDURE

All of the kindergarten children, ranging in age from five years six months to six years of age, in the Providence Elementary School in Logan, Utah, were utilized for this study. All of these children came from middle and upper-middle-class families. Thirty-four of 70 kindergarten children were in this age range. This group was then divided at random into two groups. In an effort to get equivalent samples, their names were arranged alphabetically by sex and every other name was taken for the experimental group. Those names not selected then became the control group. Each group had an equal number of males (7) and females (10).

Teaching Instructions

Each subject in the experimental group was given one 10-minute learning period, individually, each day for three days, designed to teach him conceptual operations that would aid him in understanding spatial and numerical properties, analyzing part-whole relations, conservation of quantity, and one-to-one correspondence. Two different devices were used in teaching these concepts. The subjects were first given nine matchsticks, about two inches long; shown the following six geometric figures, one at a time on three-by-five inch cards; and asked: "How many sticks will it take to make this figure?"
After the above question was answered correctly, the subject was told to make a figure with the sticks that looked just like the design on the card. If the figure was then made incorrectly, appropriate instructions and comments were given to teach the subject to see part-whole relationships and one-to-one correspondence. If the figure was reproduced on an angle or if the parts were not touching where they should be, spatial, vertical, and horizontal orientation was explained. Each of the experimental subjects was required to reproduce all of the matchstick figures correctly before proceeding to the next task.

The second device utilized was two marble-form boards constructed out of one-quarter-inch plyboard. Each board was one foot square with 100 3/8-inch holes arranged evenly in rows and columns. Marbles were provided to put into the holes to form the figures. Nine geometric figures were used; however, only two of the subjects were able to master all nine designs in the time allotted. Three completed eight designs, six completed seven designs, five completed six designs, and one completed only five designs.

Each figure was first reproduced on a marble-form board from designs drawn on 3-by-5-inch cards. The subjects were shown how to reproduce the geometric figures in space by situating correctly the critical parts of the whole figure and the concept of vertical and horizontal orientation. One-to-one correspondence was demonstrated to each subject by counting the number of marbles used to form each part of the whole figure. The subject was then told to make a figure exactly like the one made by the experimenter. If the subject could not complete the task, it was redemonstrated until he could do it. The subject was then asked to tell how he accomplished each task and to verbalize the steps he went through.
in reproducing the figures to determine if he was using a perceptual approach or an analytical and conceptual approach. The following symbols and instructions were used for teaching the above-mentioned concepts. All of the below figures were constructed on one of the marble-form boards by the experimenter as he explained how to make the figure.

"We are going to play a game. I want to see if you can make some figures with these marbles, just like the ones I make. I will help you at first, but I want you to learn to make them yourself."

Figure 1. "This figure has two lines, one running up and down and the other running across. There are five marbles in a row running this way (vertical) and five marbles in a row running this way (horizontal). You will notice that there are two marbles on both sides of the vertical row. Now you do it and tell me how you make the figure."

Figure 2. "This figure also has two lines, but instead of running up and down and across, they are on an angle. There are three holes between these two marbles (top) and three holes between these two marbles (bottom) and three holes between the two marbles on both sides. This design is easy to build if we first put in the marbles that outline the figure--the four outside marbles and this center one where the lines
cross. Remember, there are three holes between each outside marble and only one hole between each of these marbles and the center one. Now you do it and tell me how you make the figure."

Figure 3. "This figure has one line across and one line that angles up. If we put a marble for this end of this line (left-horizontal) and one for the other end (right-horizontal) and one for the top of the angled line, we have an outline of our figure. Now all we have to do is fill in the empty holes between. Now you do it and tell me how you make the figure."

Figure 4. "This figure has three lines--one running across and two up and down on an angle that forms a point at the top. If we first put a marble where each corner will be, we will have an outline of the figure. Notice there are five holes between the two bottom marbles and two holes between the bottom marble and the top marble on both sides. Now you do it and tell me how you make the figure."

Figure 5. "This figure has four lines. All of them are on an angle. If we put a marble in for each corner, like we did on the last figure,
we have an outline of the figure. We put one marble at the top, count
down three holes, and put another marble in the fourth hole. Then we
go to the center hole between these two marbles and go over two holes
left and two holes right to put in our other two marbles. Now we put a
marble in each of the empty holes between the marbles we have in, and we
have our figure. Now you do it and tell me how you make the figure."

Figure 6. "This figure has two lines on angles that cross each other
and a line across the top and one across the bottom. We put a marble in
for each corner. There are three holes between each marble. Now we
put a marble in the center where the two lines cross. Now all we have
to do is fill in the spaces. Now you do it and tell me how you make the
figure."

Figure 7. "This is two figures, one touching the other. Let's put
a marble where each corner is. The first figure has three corners--one
at the top, one down in the sixth hole below it, and one in the third hole
to the right of the center between the other two marbles. We make the
second one the same way. Now you do it and tell me how you make the
figure."
Figure 8. "This also is two figures (two squares), but instead of just touching, the one figure is partially inside of the lower right-hand corner of the first figure. First we make the corners for the first figure; there are two empty holes between each marble. Now fill in the empty holes. The second figure we make the same way. We put the upper left-hand corner just inside of the lower right-hand corner of the first figure. Our next corner is in the third hole to the right, the next is in the third hole down, and the last corner is the third hole to the left of this corner (lower right). Now fill in the empty holes between. Now you do it and tell me how you make the figure."

Figure 9. "This figure is the same as the last one we made, except the lower figure is partially in the lower left-hand corner of the upper figure (instead of the lower right side). We make it the same as before--put a marble in for each corner of the first figures, two spaces between each corner. Now fill in the spaces. Now put the upper right-hand corner of the second figure just inside the lower left corner of the first figure. Now go over to the third hole for the upper left corner and down to the third hole for the bottom left corner and to the right three holes for the lower right corner. Now fill in the empty holes. Now you do it and tell me how you make the figure."
At the completion of the third 10-minute training session, each subject was administered the Bender-Gestalt Test individually.

Each subject in the control group was also given three individual 10-minute sessions with the experimenter over a period of three days. However, the control subjects looked at and named pictures in a book, or just conversed with the experimenter. At the end of the third session, each control subject was administered the Bender-Gestalt Test individually.

The test results from both groups were then scored for the following 26 errors that are considered significant indicators of immaturity in visual motor perception by Koppitz in her 1964 scoring system, or by Pascal and Suttell in their 1951 scoring system.

**Scoring Procedure**

**Koppitz scoring errors**

Figure A:

Distortion of shape
1. Square or circle or both are excessively flattened or misshapen; one axis of circle or square is twice as long as the other one. (p. 16)

Examples:

![Error Not scored Error Not scored Error](image)

2. Disproportion between size of square and circle; one is twice as large as the other one. (p. 16)

Examples:

![Error Not scored Error](image)

1 Descriptions of errors in this section are taken from Koppitz (1964), pp. 16-32. Examples of errors were drawn by the author.
Rotation
3. Rotation of figure or any part of it by 45° or more; rotation of stimulus card even if then copied correctly in rotated position. (p. 16)

Examples:

Integration
4. Failure to join circle and square; curve and adjacent corner of square more than 1/8" apart; this applies also to overlap. (p. 16)

Examples:

Figure 1:
Rotation
5. Rotation of figure by 45° or more; rotation of stimulus card even if then copied correctly as shown on rotated card. (p. 18)

Examples:
Figure 3:
Integration
6. Shape of design lost; failure to increase each successive row of dots; shape of arrow head not recognizable or reversed; conglomeration of dots; single row of dots; blunting or incorrect number of dots not scored. (p. 22)

Examples:

Error Error Not scored

Figure 4:
Rotation
7. Rotation of figure or part of it by 45° or more; rotation of stimulus card even if then copied correctly as shown on rotated card. (p. 24)

Examples:

Error Error Not scored

Integration
8. Curve and adjacent corner more than 1/8" apart, this applies also to overlap; curve touches both corners. (p. 24)

Examples:

Error Error Error Not scored
Figure 5:
Rotation
9. Rotation of total figure by 45° or more; rotation of extension, e.g., extension points toward left side or extension begins left of center dot of arc; rotation is only scored once even if arc and extension are both rotated independently of each other. (p. 26)

Examples:

Error Error Error Not scored

Figure 6:
Distortion of Shape
10. Three or more distinct angles substituted for curves (in case of doubt not scored). (p. 28)

Examples:

Error Error Not scored

11. No curve at all in one or both lines; straight line. (p. 28)

Examples:

Error Error Not scored
Integration

12. Two lines not crossing or crossing at the extreme end of one or both lines; two wavy lines interwoven: (p. 28)

Examples:

Figure 7:
Distortion of Shape

13. Disproportion between size of two hexagons; one must be at least twice as large as the other one. (p. 30)

Examples:

Figure 8:
Rotation

15. Rotation of figure by 45° or more; rotation of stimulus card even if then copied correctly as shown on rotated card (turning of paper in order to make most economical use of paper not scored and should be noted on the protocol). (p. 32)

Examples:
Pascal and Suttell scoring errors

Figure 1:
16. Number of dots . . . The stimulus for design 1 consists of 12 dots. If, in the reproduction, the number of dots is less than 10, or more than 14 (and the dots are yet a part of the design, not "extra-scattered" dots) the item is scored. (p. 113)

Examples:

Error Error Not scored

Figure 2:
17. Circles missing or extra in the column . . . Extra circles may appear in any of three ways: 1) as additions to the individual columns, 2) as over-lapping circles in a single column, or 3) as a result of the design being reproduced by rows rather than by columns. (p. 119)

Examples:

Error Error Not scored

18. Number of columns . . . The stimulus for design 2 consists of 11 columns of circles. If, in the reproduction, the number of columns is less than nine, or more than 13, the item is scored . . .

N.B. If there are 6 or less columns, the reproduction is scored for "part of the design missing," item 19. (p. 121)

Examples:

Error Error Not scored

1Descriptions of errors in this section are taken from Pascal and Suttell (1951), pp. 113-195. Examples of errors were drawn by the author.
19. Part of the design missing. . . . If the design is reproduced with six or fewer columns, or with two instead of three rows, the item is scored. (p. 124)

Examples:

Error Error Not scored

Figure 3:

20. Number of dots. . . . The item is scored when there are more or less than 16 dots, dashes, or circles in the reproduction. (p. 129)

Examples:

Error Error Not scored

21. Extra row. . . . The item is scored when there are more or less than 16 dots, dashes, or circles in the reproduction. (p. 129)

Examples:

Error Not scored

22. Part of the design missing. . . . The item is scored when one of the rows is completely missing in the reproduction. (p. 133)

Examples:

Error Not scored
Figure 4:
23. Part of the design missing. . . . The item is scored when more than one third of either the square or the curve is missing. (p. 147)

Examples:

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Figure 5:
24. Number of dots. . . . The item is scored when there are fewer than 10, but more than five dots in the curve, and when there are fewer than four dots in the extension. (p. 154)

Examples:

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25. Part of the design missing. . . . The item is scored when the extension or at least half of the curve is missing. (p. 157)

Examples:
Figure 8:
26. Angles missing. . . . The item is scored when an angle is missing in either the hexagon or the diamond . . . .
(p. 195)

Examples:
RESULTS

The hypothesis that the children who were taught to use analytical and conceptual thinking strategies would have lower error scores on the Bender-Gestalt Test than those children who were not given this training was not clearly substantiated by this study, although the direction of the small difference favors the hypothesis. The results are summarized in Table 1.

Table 1. Means and standard deviations of the experimental and control groups on the Bender-Gestalt Test using 26 scoring items from the Koppitz and Pascal and Suttell scoring systems

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>t-test&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td>7.88</td>
<td>3.49</td>
<td>1.69</td>
</tr>
<tr>
<td>Control group</td>
<td>10.17</td>
<td>4.18</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>not significant.

An inspection of the data shows that no statistically significant differences in error scores on the Bender-Gestalt Test were found between the group receiving training and the group not receiving training.

This research indicates that teaching five-year-old children analytical and conceptual thinking strategies cannot be depended upon to generalize to their correctly reproducing figures on the Bender-Gestalt Test.
DISCUSSION

Although the results of this study did not reach the desired level of confidence, the difference was in the predicted direction. One possible explanation for this failure to find a significant difference between the Bender-Gestalt protocols for the two groups may be that the training was not extensive enough. The investigator subjectively rated each experimental S on his use of the thinking strategies at the end of each training session. Although all of the Ss improved in the use of these strategies, the final training period found many of them not using the concepts adequately. It is also possible, however, that the concepts were too difficult for children in this age group to grasp.

Five-year-old children have a rather limited vocabulary, and although they appeared to understand the concept being taught, they were often unable to verbalize the procedure they used in reproducing the figures on both the matchstick and marble-form board problems. Their verbalization of vertical-horizontal orientation was quite limited and they found it very difficult to express procedures they used in reproducing angles. Another problem was that some children did not have the conceptual-motor control necessary to avoid some errors, such as integrating the parts of a figure and correctly situating the angles on figures.

It was also difficult to motivate them to work independently, and they would often haphazardly arrange the marbles with little more than a glance at the stimulus figure and then look to the experimenter for directions.
Table 2. Piaget's concepts and a list of errors from the Koppitz and Pascal and Suttell scoring systems indicating faulty application of these concepts by the two groups

<table>
<thead>
<tr>
<th>Piaget's concepts</th>
<th>Scoring</th>
<th>Experimental group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation of numerical correspondence</td>
<td>Extra or missing angles or dots (Figures A, 1, 2, 3, 4, 5, 7, 8)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Unanalyzed perceptions seeing part-whole relationships</td>
<td>Angles or straight lines for curves (Figures 3, 6)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Arrangement of stimuli in space</td>
<td>Rotation of design by 45 degrees (Figures A, 1, 4, 5, 8)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Conceptualizing the total figure</td>
<td>Failure to integrate parts (Figures A, 4, 6)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Total errors</td>
<td>134</td>
<td>173</td>
</tr>
</tbody>
</table>

<sup>a</sup>Figures referred to are found on pages 22-30.
SUMMARY

This study was designed to examine the effect teaching five-year-old kindergarten children analytical and conceptual thinking strategies would have on their subsequent performance on the Bender-Gestalt Test. The Ss were 34 kindergarten children from the Providence Elementary School. These Ss were randomly divided into two groups. One group was given three 10-minute training sessions over a three-day period designed to teach them analytical and conceptual thinking strategies. The hypothesis that the group receiving this training would have lower error scores on the Bender-Gestalt Test than those Ss not receiving this training was not substantiated at a statistically significant level by this study. The direction of the small difference did, however, favor the hypothesis.


VITA

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