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The Effect of a Structured Tutorial Program on the Cognitive and Language Development of Culturally Disadvantaged Infants.

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Based on the belief that structured preschool activities aid in the development of disadvantaged children, this study attempted (1) to evolve a tutorial program to accelerate spontaneous development in disadvantaged children and prevent cognitive and language deficits, and (2) to assess growth of the infant's cognitive and language development after 1 year of individual tutoring. Ten children (male and female, Negro and Caucasian, 8 to 24 months old) received intellectual stimulation for 1 hour a day, 5 days a week, for 1 year. A matched control group received no stimulation. Pretests and posttests were administered. The training program emphasized language development, symbolic representation, and concept formation. The results showed that sample values of the experimental group were superior to those of the control group in 25 of 26 variables tested, eight being significant at the .05 level. IQ scores of the experimental group were greater than those of the control group, and the difference was significant at the .05 level. Sample values of the experimental group exceeded those of the control group on 14 of 15 language subtests, two being significant at the .05 level. On tests administered to assess conceptual development, the experimental group was consistently superior to the control group. Followup studies should be done to determine long term effectiveness of the program. References and tabulated data are included. (JS)

The Effect of a Structured Tutorial Program on the Cognitive and Language Development of Culturally Disadvantaged Infants

by
Genevieve Painter, Ed. D.

Simple observation discloses obvious differences in language and cognitive development between culturally disadvantaged and advantaged children upon entering kindergarten. Research studies have shown that although significant differences are not found between infants of differing cultural backgrounds by the age of fifteen months, such developmental deficits are well established even by age three years (Pasamanick and Knoblock, 1961; Bayley, 1965). The question of whether or not preschool experience can help to correct these deficits has become involved in further controversy between the traditional or child centered nursery school program and the structured preschool curriculum. Early reports of research projects involving curriculum innovation indicate that the structured curriculum effects the more pertinent changes in the development of disadvantaged preschool children (Weikart, 1967; Karnes et al., 1966).

The efficacy of intervention before the age of three has not, however, been widely explored, although Skeels certainly suggests in his follow-up study (1966) the efficacy of very early intervention upon long-term results. Much has been written describing the spontaneous intellectual growth of infants (Gesell, 1940; Piaget, 1963), but little can be found concerning either efforts or theories relative to consciously-sought and planned acceleration of growth.

Problem

This investigation is a part of a larger project designed to evaluate the effectiveness of various preschool programs and to determine the strategic age at which educational intervention produces maximum acceleration of the language and cognitive development of culturally disadvantaged children.[1] This paper

[1]The research project is being supported by a grant from the Bureau of Research of the U.S. Office of Education (USOE 5-1181, Contract 6-10-235).

reports the first phase of a study with culturally disadvantaged infants which had two major purposes: (1) to evolve a structured tutorial program which would accelerate the spontaneous development of these infants and prevent anticipated cognitive and language deficits, and (2) to assess the growth of these infants after one year of individual tutoring particularly in the areas of cognitive and language development.

Method

Selection of Sample

The subjects were the younger siblings of four-year-olds attending an experimental nursery school for culturally disadvantaged children in the community of Champaign and Urbana, Illinois. Thirty infants whose ages fell between eight and twenty-four months, whose medical examination revealed no evidence of a physical limitation, and whose measured intelligence was within the range of 80 to 120 on the Cattell Infant Intelligence Scale were randomly assigned to an experimental and control group. Random assignment, however, resulted in an unequal distribution of ages, of male and female subjects, and of races between the groups. Adjustments were made to create groups which would be comparable in age, sex and race. In order to hire and to train the tutors and to develop a workable curriculum, the thirty infants entered the program over a period of six months. The results of only the first twenty children are reported in this paper.[2]

These twenty children comprised two groups as follows:

The experimental group consisted of ten subjects, male and female, Negro and Caucasian, eight to twenty-four months old, who received

[2]The data for the thirty infants after one year of tutoring and a follow-up comparison between these children at age four with the pre-nursery school performance of their older siblings will be analyzed in the future.

individual structured intellectual stimulation within their homes for one hour a day, five days a week, for a period of one year.

The control group consisted of ten subjects, male and female, Negro and Caucasian, eight to twenty-four months old, who received no structured intellectual stimulation for a period of one year.

TABLE I
Experimental and Control Group Comparisons on Sex, Race, IQ, and Health Measures

Variable	Experimental Group	Control Group
Male	6	6
Female	4	4
Negro	8	6
Caucasian	2	4
Cattell Infant Intelligence Scale		
$\bar{X}$ IQ	98.8	98.4
$\bar{X}$ Month CA	15.5	15.7
$\bar{X}$ Month MA	15.3	15.2
$\bar{X}$ IQ of four-year old siblings, Stanford-Binet, Revised 1960	93.0	93.6
$\bar{X}$ Age at medical examination	17.7	17.3
$\bar{X}$ Weight	24.3	25.1
$\bar{X}$ Height	31.1	31.4
# S's 9.5 gms or less, Hemoglobin	4	4
# S's with Physical Limitations*	1	0

*One experimental subject later was found to have occasional mild seizures.

Testing Procedure

All infant subjects were examined individually in their homes by female, qualified psychologists who had experience testing young children. They were uninformed as to whether the child was a member of the experimental or the control group. One psychologist administered the pretests, another psychologist the posttests. Qualified psychologists administered the Stanford-Binet to the four-year-old siblings in testing rooms at the nursery school prior to the beginning of classes.

Tutoring Procedure

Female tutors worked individually with each experimental subject in his home for one hour a day, five days a week, over a period of one year. The tutors were selected on the basis of their experience and interest in working with very young children and for their positive attitude toward culturally disadvantaged families. They had a variety of professional backgrounds: elementary education, child development, music education, and nursing. One had a master's degree and the others had bachelor's degrees. An orientation week initiated the tutor training; tutors read and discussed pertinent literature and made home visits. In-service training continued throughout the year.

The Outline of Language Development (Fokes, 1965a), the Outline of Motor Development (Fokes, 1965b), and the Instrument for Assessing Infant Psychological Development (Uzgiris and Hunt, 1966) were administered to each experimental subject at the time of his entry into the project. In general, these test findings and those from the subtest of the Cattell Infant Intelligence Scale indicated that the training program should emphasize language development, symbolic representation, and concept formation. The infants were not found to be deficient in gross-motor development; however, since fine-motor skills

were just emerging in these infants, such skills were stressed in the training.

Each infant began with a program designed to meet his developmental level and amended to take account of his subsequent progress. During home visits the writer who served as the program supervisor evaluated the effectiveness of the training by observing the infant's performance and comparing it periodically to developmental schedules (Gesell, 1940; Fokes, 1965a, 1965b). Each week the supervisor met individually with the tutors and with the tutors as a group. Further in-service training of the tutors was conducted at these sessions and specific activities were evaluated for their appropriateness to a given infant's progress and for their interest and value to the infants in general.

Training Program

The training program was designed to emphasize language and conceptual development since the test findings indicated deficiencies in these areas. A few of the activities which were used are presented below.

Language Training

The low language ability of these subjects was consonant with the findings of studies on disadvantaged preschool and elementary school children. Consequently, language development was encouraged in all activities. When the child was given manipulative materials, the tutor emphasized words which she had planned to use in the activity and words which evolved naturally during the session.

In addition to the encouragement of speech in all activities, a structured language program was presented to each child: (1) beginning language, (2) elaborative language, (3) the breaking down of "giant word units," and (4) the encouragement of internal dialogue. Each child's language program was initiated at his own level of development. A few examples of the activities are

presented below:

The following progression was devised in presenting beginning language activities: (1) The child who did little babbling or who spoke few words was taught to imitate the tutor's vocal sounds by first imitating the sounds he had already made spontaneously and later imitating sounds which the tutor devised. (2) The child was shown objects found in his environment and encouraged to repeat their names. (3) A highly structured activity which included the identification of pictured objects, the differentiation between two or several pictured objects, the verbal labeling of pictured objects, and the demonstration of the usage of pictured objects was given each child. (4) When a child was able to talk, tutors discouraged gestures or grunting by telling the child how to ask for an item and then not giving it to him unless he said the word or words. If the child could say "wah-wah" for water this was accepted, but when he could later say "water" he was expected to say it precisely. Still later when he could combine words he was told to say "I want water." (5) Although the child was shown what he should do through tutor demonstrations of materials, he was also expected to follow verbal instructions, e.g., "Put the toy back in the box."

Elaborative Language was encouraged in the following ways: (1) Dramatic play, rhymes, and songs encouraged the extention and spontaneity of speech. (2) Adjectives and adverbs were used by the tutor and the child imitated, e.g., "This is a blue car," or "The car goes fast." (3) Objects, paper doll cut-outs, and parts of the body were used for teaching prepositions, e.g., "Put the penny in your hand, under your foot, between the mother and father doll." (4) Many teaching devices were used to teach antonyms, e.g., "warm-cold" milk, juice, water, ice.

The breaking down of "giant-word units" as suggested by Bereiter and

Engelmann (1966) was encouraged. The child who said, "Tha-ha" was encouraged to say "That hat," or "That is a hat" depending upon his level of speech development. Tape recorders, the Bell and Howell Language Master Machine, and dolls equipped with tape recorders were used.

In problem solving one may carry on an internal dialogue which can direct orderly progression toward a solution. All manipulative activities which required time to observe the problem and to plan for a solution were verbalized by the tutor to encourage such a dialogue. Imitative speech was encouraged as the child worked. For example, in working a puzzle the child was told, "We start at the head; turn the piece around until it will fit." After the child had completed the puzzle several times, the tutor was silent; the child often verbalized the plan, but at times he was silent as he worked. At such times, it may be that the child was saying the dialogue to himself, or internalizing it.

Conceptual Training

The differentiation between language growth and conceptual growth in an individual is only theoretical, since they are combined in the spontaneous development of the child. They were considered somewhat independently in this study to help in the construction of the tutorial curriculum. The concepts of (1) body image, (2) space, (3) number, (4) time, and (5) categorical classification were selected for emphasis because they are believed to be necessary prerequisites for academic learning and because the beginning levels of these concepts, if presented appropriately, may be initiated at an early age.

Body image concept is the mental image one has of his own body at rest or in motion at any moment. The following activities are typical of those presented to each child to develop this concept: (1) Each tutor carried a mirror in her toy case because there was an absence of mirrors in many homes. The child

pointed to various parts of his body upon request, named body parts when the tutor pointed and asked the name of a part, and observed himself in the mirror after placement of a string of beads around his neck. (2) The child pointed to parts of the body on a doll or puppet and then on himself. (3) The child placed his hand or foot on paper or lay down on a large piece of shelf paper; the tutor traced an outline with a felt-tip pen.

Included in the concept of space were activities for the development of form perception, size perception, spatial relationships and seriation. (1) The child was trained to perceive the form of an object by placing forms (cylinders, cubes, triangles) in their corresponding holes in the top of a box. He was taught to draw geometric figures using templates and in free-hand drawings. (2) Graduated rings were placed on a pyramid shaped structure, the largest ring fitting at the base to teach size perception. Large and small cardboard chips were also used. (3) The amount of space necessary for objects, spatial relationships between objects, and position in space were stressed in the training using nested cubes, poker chip designs, and puzzles. (4) Nested cans and boxes were used to teach seriation of objects.

Number concept activities were introduced by: (1) differentiating "One" from "many" or "more." Pennies or cereal bits were placed in front of the child. He was asked for "one" and then for "more" or "many pennies." The tutor taught the task by giving these to the child at first. (2) The concept of oneness was taught by having the child put one penny in his own cup and one in the tutor's; he continued to alternate placement until he placed all that were given to him. (3) The child was taught the concept of twoness by holding two pennies in his hand and then placing them in a box. He was then given three to five boxes and six to ten pennies, and was told to place the pennies in

each box after first holding two in his hand. The task was later taught in the same manner for threeness. (4) In addition to the above, the child was taught to count to ten by rote. He, of course, did not understand the concept of each number, but learned the progression of symbols.

Temporal awareness (time concept) was stressed throughout the training program as a part of the natural sequence of events: (1) The session followed an orderly progression during the time spent with the child. The tutor mentioned the sequence as they worked: puzzle time, juice time, painting time, time for teacher to go home. (2) Daytime, morning, breakfast time, lunch time, dinner time, sleeping time were frequently mentioned to the child. (3) The tutor said to the child, "I'll see you tomorrow." "When I was here yesterday you showed me your cat." "Today we'll paint."

Classification concepts (the ordering of objects and placing them into meaningful categories) were taught to the child in a variety of activities: (1) Three or four pictures, all alike but one, were placed on the table. The child was told, "Give me the one that is different." "Give me the one that does not belong with the others." At another time, three or four different pictures were placed in front of the child and he was told, "Give me the one that is the same as this one in my hand." (2) Pictures cut from children's books and popular magazines were collected by each tutor. The child learned to classify pictures into two, and then into three categories. People, foods, dogs, cats, and birds were the categories of pictures which were used. (3) The child was taught to categorize objects by color.

Data Analysis

Each of the tests and subtests used to compare subjects' performance was examined by analysis of covariance (Blalock, 1960), holding mental age and

chronological age constant, with the exception of the Stanford-Binet in which only the chronological age was held constant. The analysis of covariance was preferred over other tests because it eliminated that part of each criterion variable which was related to age level, thus providing a more accurate analysis as well as a more powerful test. The basic assumption of analysis of covariance was met by a homogeneity of regression test. In all but two variables there was homogeneity of regression; the Chi Square test was then used to further analyze the two variables which did not meet the assumption of homogeneity of regression.

Results

The instruments used in the posttest battery were inappropriate to the initial CA of the subjects and could not, therefore, be used as pretest measures. However, as shown in Table I, the groups were found to be comparable on the pretest measures which were used. The following tests were used at the post-test to measure general intellectual performance, language development and conceptual development: The Stanford-Binet Intelligence Scale, Revised 1960; The Illinois Test of Psycholinguistic Abilities (ITPA), Unpublished Revised Edition (Kirk, McCarthy, Kirk, 1967); Language subtests of the Merrill-Palmer Scale of Mental Tests; The Visual Closure subtest of the Minnesota Preschool Scale; Six subtests of conceptual development of the Merrill-Palmer Scale of Mental Tests; and two tests for the concept of color devised by the author. In addition to these, seven subtests of the Merrill-Palmer Scale of Mental Tests were used to assess possible differences in sensory-motor development between the groups since this was a technique used in training language and conceptual development.

Measured Intelligence

The test-retest intelligence quotients for the experimental and control

groups are presented graphically in Figure 1. The pretest performance of both groups on the Cattell Infant Intelligence Scale were comparable; the experimental group mean IQ was 98.8 and that of the control group, 98.4. At the posttest, the performance of the experimental group exceeded that of the control group on the Stanford-Binet Intelligence Scale; the experimental group mean IQ was 108.1 and the control group mean IQ was 98.8, a difference of 9.3 points.[3]

Table 2 shows the statistical analysis of posttest performance of the experimental and control groups on the Stanford-Binet Intelligence Scale. The analysis of covariance holding chronological age constant was used to determine if the groups differ significantly in mean mental age. It will be noted that even with the small sample of ten in each group, the analysis of covariance indicated the difference to be significant at the .05 level.

TABLE 2
Experimental and Control Group Comparisons on Posttest Stanford-Binet Intelligence Scale

Variable	Mean Scores Exp.	Mean Scores Cont.	Adjusted Mean Scores Exp.	Adjusted Mean Scores Cont.	F Ratio Regression	F Ratio Analysis of Covariance
Month Mental Age	32.7	29.2	32.360	29.540	0.394	5.136*
IQ	108.1	98.8				

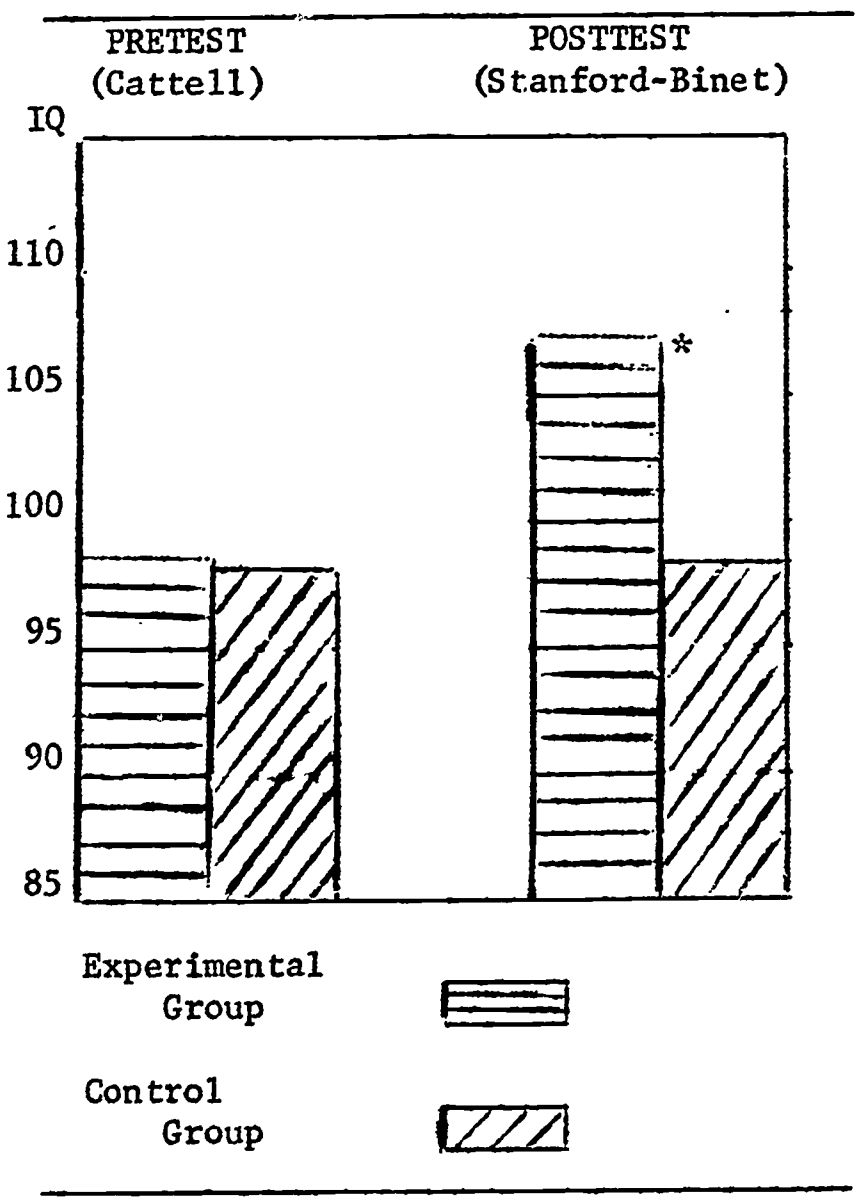
*Significant at the .05 level.

The mean IQ of the four-year old experimental group siblings was 93.0 and that of the control group siblings, 93.6. The posttest IQ's of the experimental subjects of this study was 108.1 and that of the control group 98.8. No direct

[3]The Cattell Infant Intelligence Scale was substituted for the Stanford-Binet for one experimental and two control children who were too young to perform on the latter instrument.

FIGURE 1

EXPERIMENTAL AND CONTROL GROUP COMPARISONS ON PRETEST AND POSTTEST MEAN IQ SCORES**



*Significant at the .05 level.

**The pretest IQ scores were on the Cattell Infant Intelligence Scale. The posttest IQ scores were on the Stanford-Binet with the exception of one experimental and two control children who were unable to perform on that instrument. For these three children Cattell post-test scores were used in computing posttest means.

comparisons between the performance of the young subjects at the posttest and that of their four-year old siblings can be made at this time because of the age difference; however, a comparison will be made between the IQ's of the siblings at age four before they entered nursery school and the present subjects when they become four years old.

It appears from this data that the ten children who received individual tutoring were able to perform on a test of general intelligence at a significantly higher level than the ten children who did not receive instructional intervention in the home.

Language Development

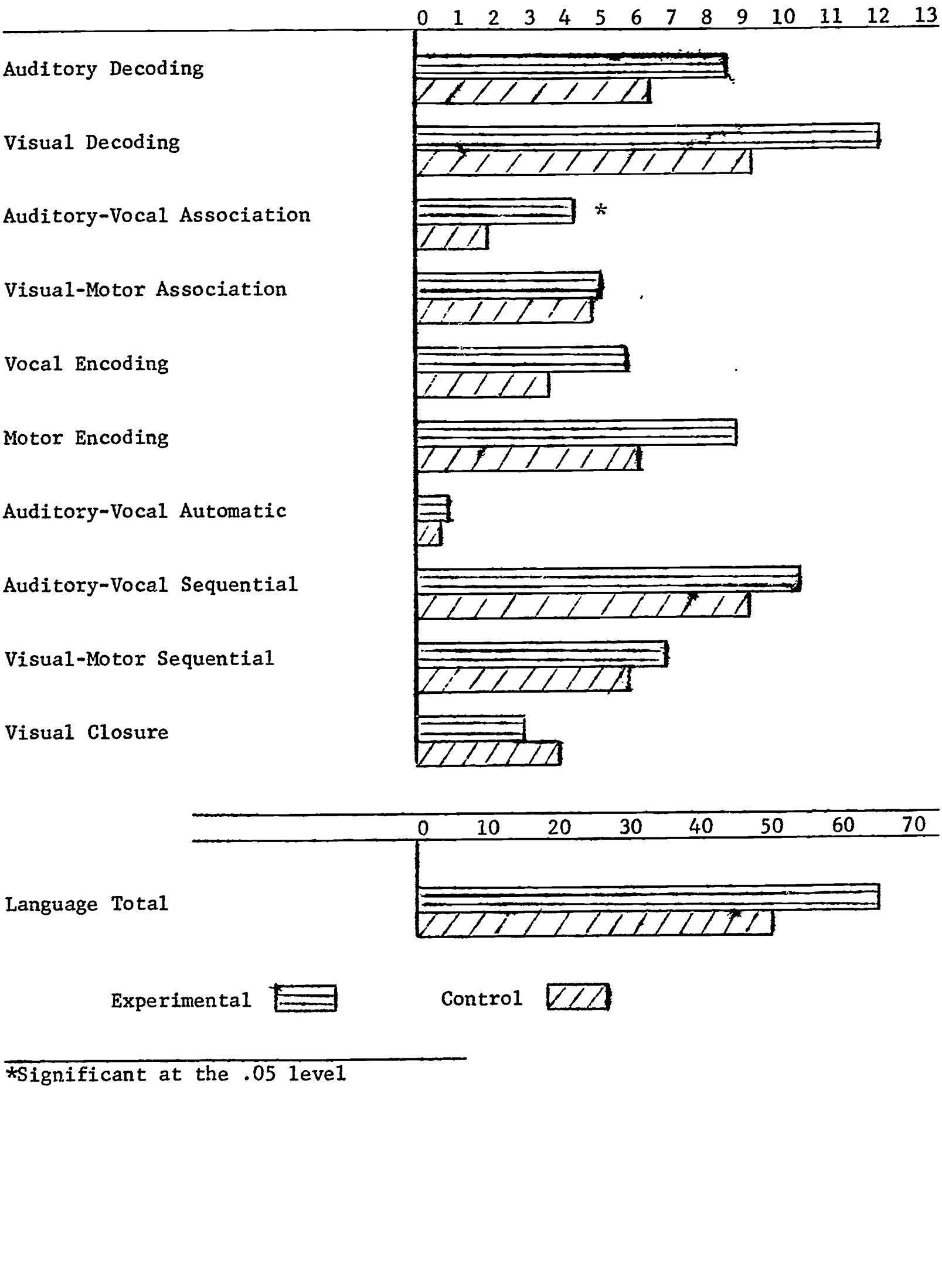
Illinois Test of Psycholinguistic Abilities (ITPA), Unpublished Revised Edition. Figure 2 offers a graphic comparison of the raw scores of the experimental and control groups on the ten subtests and language total of the ITPA.[4] The raw scores of the experimental group exceed those of the control group on the language total and on all subtests except that of visual closure.

Table 3 presents the analysis of covariance of the data. Although the sample values of the experimental group exceed those of the control group, except on Visual Closure, the differences were not statistically significant on nine out of ten subtests. The small sample of ten in each group may not have been sufficient to obtain statistical significance. The .05 level of significance attained on the Auditory-Vocal Association subtest is interesting to note because the ITPA manual (1961 edition) reports that mental age correlates highest with performance on this particular subtest. It is possible that the increase in general functioning, as demonstrated by their increase

[4]Raw scores are presented because the standardization of the revised test was not complete at the time of this writing.

FIGURE 2

EXPERIMENTAL AND CONTROL GROUP COMPARISONS ON ITPA
ADJUSTED MEAN RAW SCORES



*Significant at the .05 level

TABLE 3

EXPERIMENTAL AND CONTROL GROUP COMPARISONS ON THE ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITIES (ITPA)

Variable	Mean Scores Exp.	Mean Scores Cont.	Adjusted Mean Scores Exp.	Adjusted Mean Scores Cont.	F Ratio Regression DF 3/12	F Ratio Analysis of Covariance DF 1/15
LANGUAGE DEVELOPMENT						
Illinois Test of Psycholinguistic Abilities						
Auditory Decoding	8.1	6.8	8.653	6.247	0.431	0.968
Visual Decoding	12.7	8.5	12.071	9.129	0.216	1.568
Auditory-Vocal Association	4.4	1.5	4.217	1.684	0.391	4.754*
Visual-Motor Association	5.2	4.6	5.080	4.720	0.765	0.052
Vocal Encoding	6.3	3.5	5.481	3.319	0.671	1.874
Motor Encoding	9.2	5.4	8.725	5.875	1.125	1.997
Auditory-Vocal Automatic	0.8	0.4	0.714	0.486	0.219	0.100
Auditory-Vocal Sequencing	10.6	8.9	10.336	9.164	1.446	0.102
Visual-Motor Sequencing	6.6	6.1	6.734	5.965	0.577	0.217
Visual Closure	3.2	4.1	3.110	4.190	0.420	1.439
Language Total	67.1	49.8	65.939	50.861	0.851	2.905

*Significant at the .05 level

in MA, is related to the superior gain of the experimental group on this subtest.

Language Subtests of the Merrill-Palmer Scale of Mental Tests

Mean raw scores are reported on the language subtests of the Merrill-Palmer Scale because no actual language scale exists for this instrument. Figure 3 offers a graphic comparison of the groups. The experimental group exceeded the performance of the control group on the four subtests and on the language total. The analysis of covariance shown in Table 4 indicates that statistical significance was reached on only one subtest, Simple Questions.

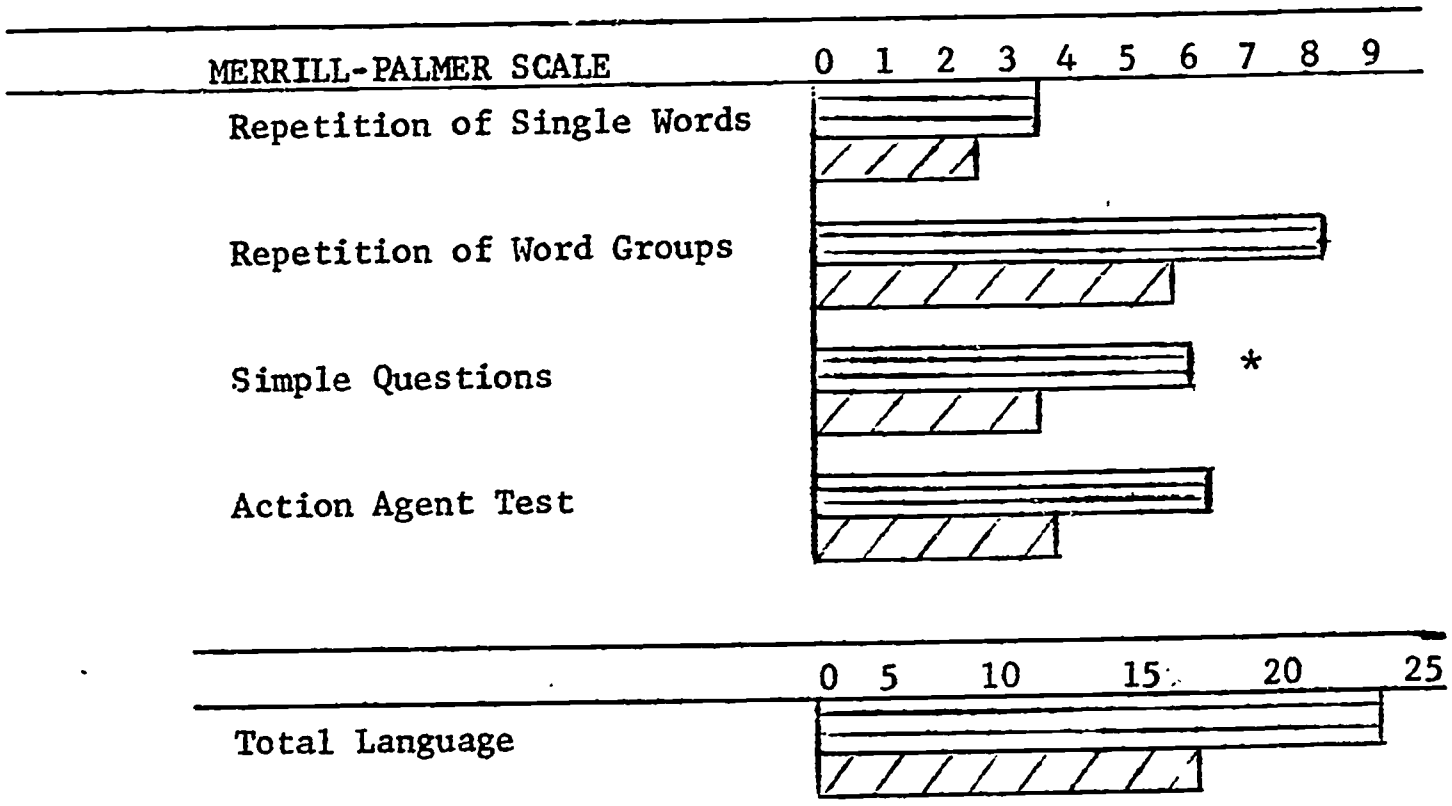
It is interesting to note the similarity of language performance on these subtests and on the ITPA, although the tasks involved in the two instruments are quite different. The sample values of the experimental group were consistently superior to those of the control group on both the ITPA and on the language subtests of the Merrill-Palmer Scale, although statistical significance was found on only one variable of each scale.

Visual Closure Subtest of the Minnesota Preschool Scale

Table 4 and Figure 3 present the results of the Visual Closure Subtest of the Minnesota Preschool Scale. The sample values of the experimental group on the mean raw scores and the adjusted mean raw scores were higher than those of the control group. The differences, however, were not found to be significant in the analysis of covariance. It should be noted that the experimental group attained a lower mean score than the control group on the Visual Closure subtest of the ITPA, but a higher mean score than the controls on the Minnesota subtest. The ITPA subtest is timed which, therefore, makes it a speed of perception as well as a closure task. The task of the Minnesota subtest involves only closure since the test is not timed.

FIGURE 3

EXPERIMENTAL AND CONTROL GROUP COMPARISONS ON MEAN ADJUSTED RAW SCORES OF LANGUAGE SUBTESTS OF THE MERRILL-PALMER SCALE OF MENTAL TESTS AND THE VISUAL CLOSURE SUBTEST OF THE MINNESOTA PRESCHOOL SCALE



*Significant at the .05 level

TABLE 4

EXPERIMENTAL AND CONTROL GROUP COMPARISONS ON THE LANGUAGE SUBTESTS OF THE MERRILL-PALMER SCALE OF MENTAL TESTS AND THE VISUAL CLOSURE SUBTEST OF THE MINNESOTA PRESCHOOL SCALE

Variable	Mean Scores Exp.	Mean Scores Cont.	Adjusted Mean Scores Exp.	Adjusted Mean Scores Cont.	F Ratio Regression DF 3/12	F Ratio Analysis of Covariance DF 1/15
LANGUAGE DEVELOPMENT (cont.)						
Language Subtests of the Merrill-Palmer Scale of Mental Tests						
Repetition of Single Words	3.4	2.8	3.362	2.837	1.109	0.516
Repetition of Word Groups	8.5	5.6	8.259	5.841	0.347	1.156
Simple Questions	6.2	3.7	6.034	3.666	0.400	4.888*
Action Agent Test	6.3	3.6	6.204	3.696	1.417	2.256
Total Language	24.4	15.7	23.859	16.041	0.913	2.960
Minnesota Preschool Scale						
Visual Closure	7.3	5.4	7.151	5.550	2.170	1.021

*Significant at the .05 level

It should be noted that the reliability of all tests at ages two to three is low. Further testing at age four should offer a more reliable account of the subjects' language development.

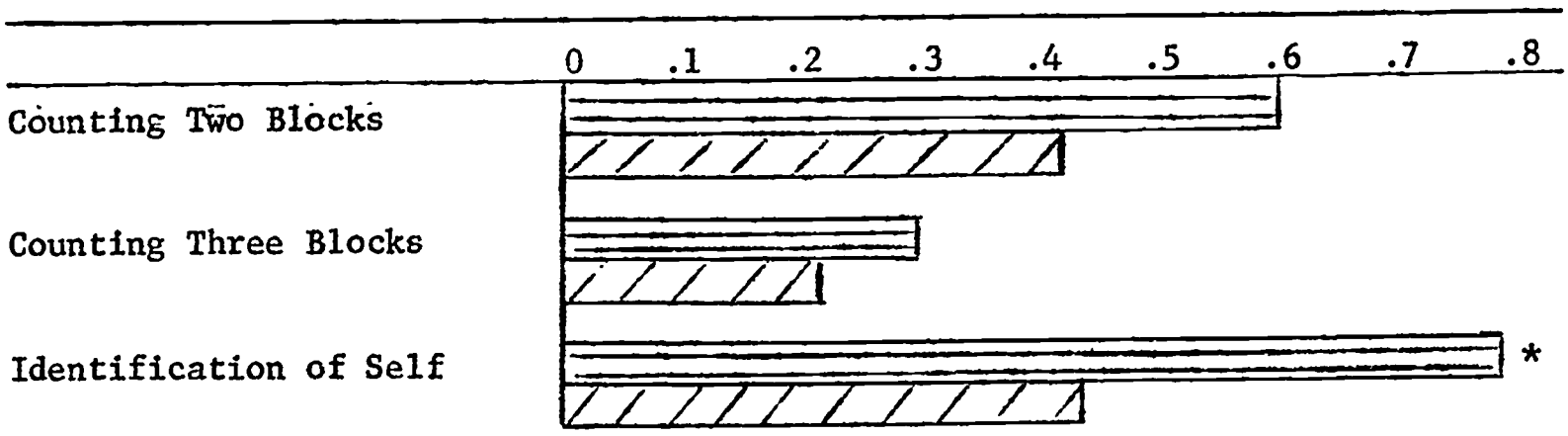
Conceptual Development

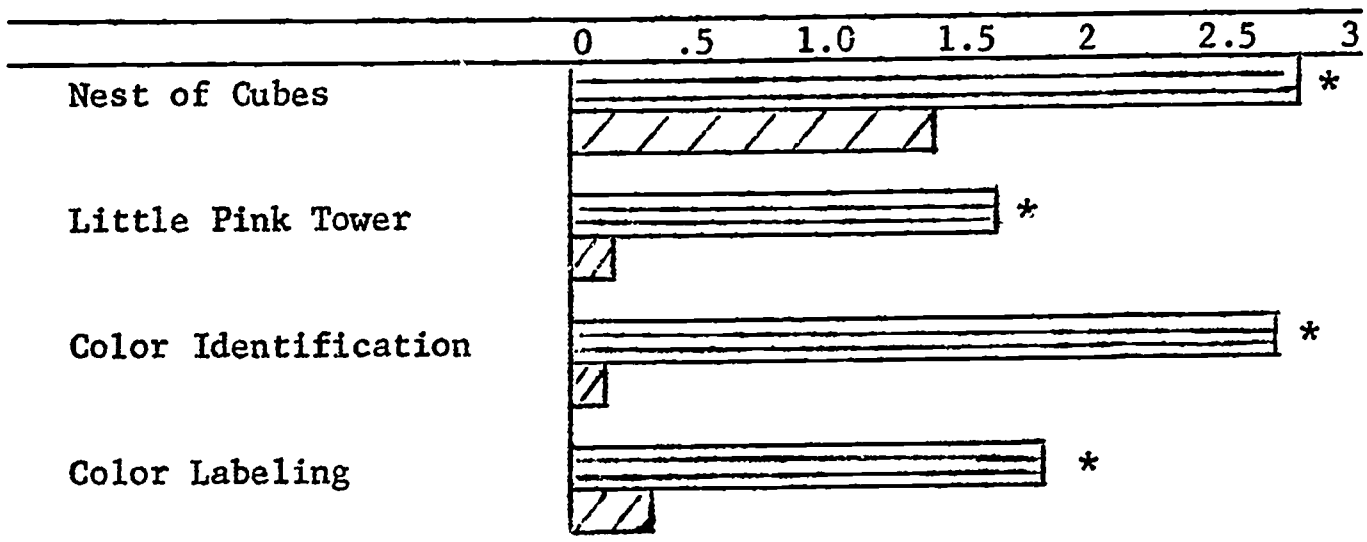
Eight instruments were used to test conceptual development. Six of these were taken from the Merrill-Palmer Scale of Mental Tests: Counting Two Blocks, Counting Three Blocks, Identification of Self in Mirror, Nest of Cubes, Little Pink Tower, and Color Matching. The tests for Color Identification and Color Labeling were devised by the author.

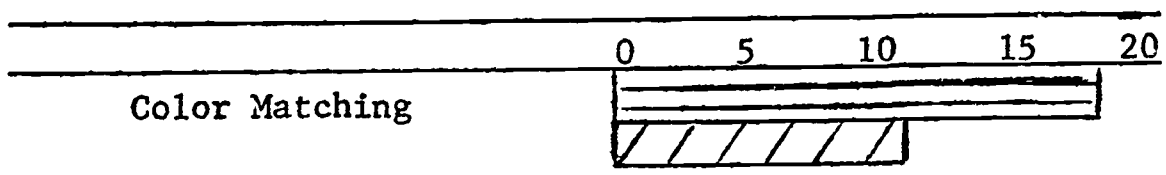
Table 5 and Figure 4 show that on all tests of conceptual development the sample values of the experimental group's performance were superior to those of the control group, and in five of the eight tests the analysis of covariance indicated that the groups differed significantly. These are: Self Identification Nest of Cubes (seriation), Pink Tower (seriation), Color Identifying, and Color Labeling. The table also shows a significant lack of homogeneity of regression on the tests of Color Identification and Color Labeling. The lack of homogeneity of variance on the two variables is probably due to the wide group differences in ability to perform the tasks. Color discrimination is not a usual part of the spontaneous development of children of this age and is the result of structured teaching. The Chi Square Test was used to further test the results of Color Identification and Color Labeling and the mean raw scores were found to differ significantly at the .05 level. Although the scores of the experimental group were higher than those of the control group on the counting tests, they did not differ significantly. It should be pointed out that conceptual development strongly correlates with intelligence level and with language ability, and therefore, the higher scores of the experimental group in conceptual development

FIGURE 4

EXPERIMENTAL AND CONTROL GROUP COMPARISONS OF ADJUSTED MEAN RAW SCORES OF TESTS OF CONCEPTUAL DEVELOPMENT







Experimental Group

Control Group

*Significant at the .05 level.

TABLE 5

EXPERIMENTAL AND CONTROL GROUP COMPARISONS ON TESTS OF CONCEPTUAL DEVELOPMENT

Variable	Mean Scores Exp.	Mean Scores Cont.	Adjusted Mean Scores Exp.	Adjusted Mean Scores Cont.	F Ratio Regression DF 3/12	F Ratio Analysis of Covariance DF 1/15
CONCEPTUAL DEVELOPMENT						
Merrill-Palmer Scale of Mental Tests						
Counting Two Blocks	0.6	0.4	0.591	0.410	1.060	0.525
Counting Three Blocks	0.3	0.2	0.299	0.202	2.410	0.243
Identification of Self in Mirror	0.8	0.4	0.777	0.422	0.431	6.248*
Nest of Cubes	2.7	1.4	2.745	1.353	0.487	7.761*
Little Pink Tower	1.8	0.0	1.615	0.185	2.822	4.787*
Color Matching	18.3	10.2	17.701	10.799	0.456	4.450
Author Devised Tests						
Color Identification	2.6	0.2	2.640	0.160	6.986* **	8.644*
Color Labeling	1.8	0.3	1.819	0.281	4.490* **	4.737*

*Significant at the .05 level

**Because of the lack of homogeneity of variance on these tests, a Chi Square was also used to examine the data; the mean raw scores were found to be significantly different at the .05 level.

are probably interrelated with those of the other two areas.

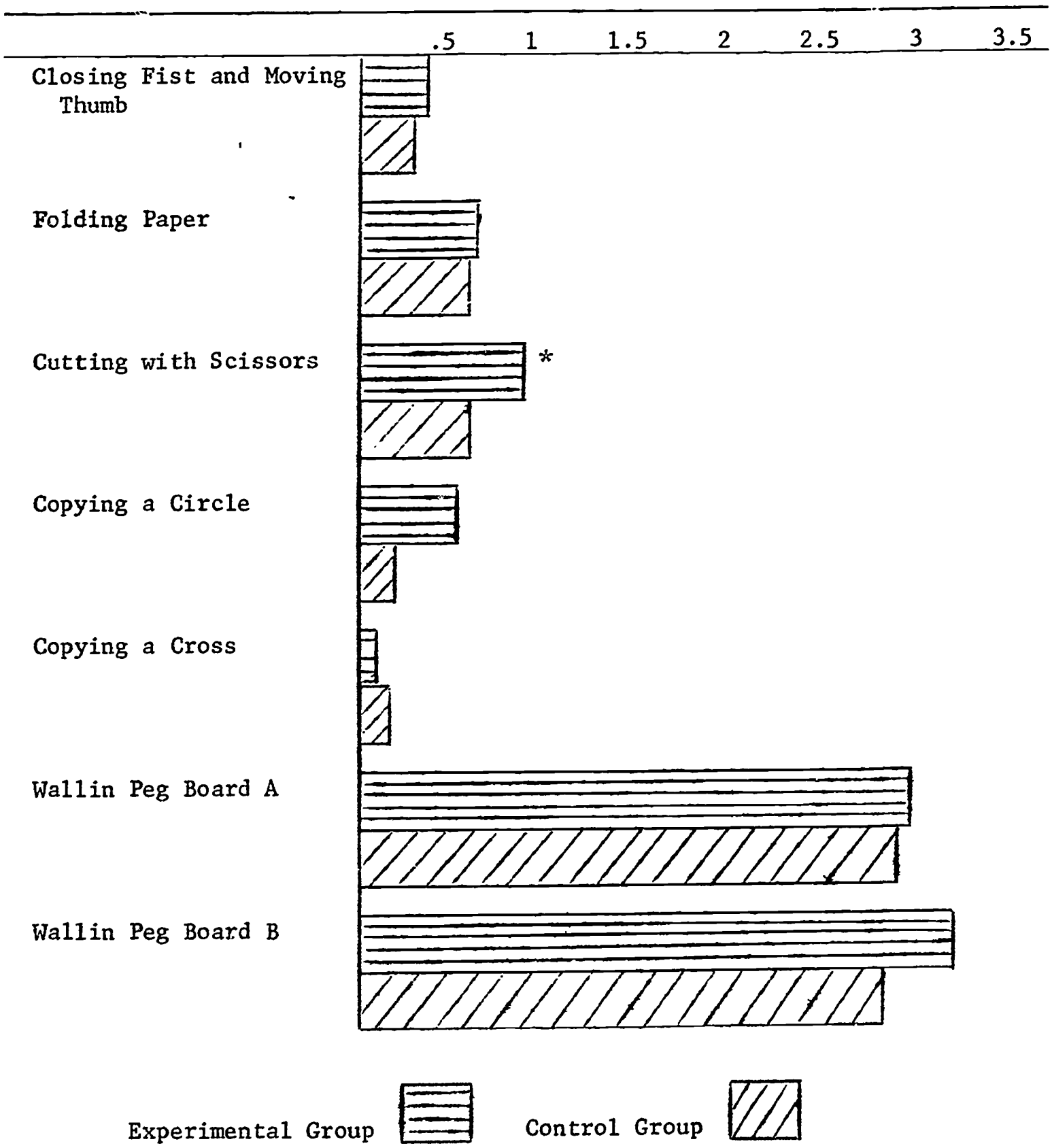
Sensory-Motor Development

The infants were not found to be deficient in motor development; however, since fine-motor skills were just emerging in these infants, and since sensory-motor techniques were used in training language and conceptual development, it was decided to give the subjects seven subtests of the Merrill-Palmer Scale of Mental Tests to assess possible differences between groups in fine sensory-motor development. These were: Closing Fist and Moving Thumb, Folding Paper, Cutting with Scissors, Copying a Circle, Copying a Cross, Wallin Peg Board A and Wallin Peg Board B.

The test findings corroborated the original findings: with the exception of cutting with scissors, the groups did not differ significantly. Moreover, examination of the graphic presentations of language and conceptual development (Figures 2, 3, and 4) in comparison with the graphic picture of sensory-motor development (Figure 5) reveals that differences between the experimental and control group in sensory-motor development are less marked. This comparison suggests that sensory-motor performance per se is not a problem in the spontaneous development of culturally disadvantaged children of this age. Piaget (1963) considers this an age of sensory-motor development which further suggests the possibility that most children of this age are able to acquire these skills whether or not they are given the advantage of specific training. However, since sensory-motor training proved to be an effective means of teaching the language and conceptual areas of the program, as evidenced by the superior scores of the experimental group in these two areas, sensory-motor training is suggested as an aid in the teaching of young children.

FIGURE 5

EXPERIMENTAL AND CONTROL GROUP COMPARISONS ON ADJUSTED MEAN RAW SCORES OF TESTS OF FINE SENSORY-MOTOR DEVELOPMENT



*Significant at the .05 level.

TABLE 6

EXPERIMENTAL AND CONTROL GROUP COMPARISONS ON TESTS OF SENSORY-MOTOR DEVELOPMENT

Variable	Mean Scores Exp.	Mean Scores Cont.	Adjusted Mean Scores Exp.	Adjusted Mean Scores Cont.	F Ratio Regression DF 3/12	F Ratio Analysis of Covariance DF 1/15
SENSORY-MOTOR DEVELOPMENT						
Merrill-Palmer Scale of Mental Tests						
Closing Fist and Moving Thumb	0.4	0.3	0.384	0.316	0.471	0.125
Folding Paper	0.7	0.6	0.679	0.621	0.471	0.101
Cutting with Scissors	0.9	0.7	0.928	0.671	0.177	5.237*
Copying a Circle	0.5	0.2	0.515	0.185	1.192	2.360
Copying a Cross	0.1	0.1	0.063	0.136	0.575	0.408
Wallin Peg Board A	3.0	2.8	2.924	2.876	2.986	0.005
Wallin Peg Board B	3.2	2.8	3.217	2.783	0.708	0.396

*Significant at the .05 level.

Summary of Results

1. A summary of results at the posttest shows that the sample values of the experimental group were superior to those of the control group in twenty-five of the twenty-six variables tested. Only eight of these variables were found to differ significantly at the .05 level, possibly due to the small sample of ten in each group.
2. The posttest mean IQ of the experimental group on the Stanford-Binet Intelligence Scale was 108.1 and that of the control group, 98.8. The difference of 9.3 points was found to be statistically significant at the .05 level.
3. The Illinois Test of Psycholinguistic Abilities, language subtests of the Merrill-Palmer Scale of Mental Tests, and the Visual Closure subtest of the Minnesota Preschool Scale were administered at the posttest to assess language development. The sample values of the experimental group were found to exceed those of the control group on fourteen of the fifteen language subtests. The differences, however, were found to be significant at the .05 level on only two subtests.
4. On the six tests of the Merrill-Palmer Scale of Mental Tests and the two devised by the author, administered to assess conceptual development, the sample values of the experimental group were found to be consistently superior to those of the control group. Five of the eight mean scores were found to differ at the .05 level of significance.

Discussion and Implications

The results of the study strongly suggest that the activities and content of the tutorial program produced a rate of acceleration within the experimental group substantially greater than the "normal" progress of the control group. The

study does not, however, answer the question of the most strategic age for educational intervention. The comparison of the performance of these subjects when they reach age four with the pre-nursery school performance of their older siblings may help to answer this question. If comparative follow-up studies during elementary school years indicate that the performance of the subjects of the present study exceeds that of their older siblings, structured infant training will have proved worth-while. Conversely, if the older siblings whose education intervention began at age four perform better or equally well in the elementary grades, infant training of the reported type should be considered unnecessary.

Extensions of the present study, other than in verification or advancement within its own framework, might move in several directions. In the present study little was done to involve the mothers in the tutoring process, since the current purpose was centered in the development of a curriculum to be administered and constantly assessed by professional teachers. An extension would be to organize a program of instruction for these motners, so that their child-rearing practices and the daily conduct of the household would be directly supplemental or reinforcing to the work of the tutors. Such an extension might lead gradually to the development of a program of education for the mothers, in order that they could take over the bulk of the actual instruction within the home, with the counsel and helpful supervision of a minimal number of qualified tutors.

Presently available day care centers do not usually admit children under the age of two and half, but if the procedures developed in this study are of value they might be instrumental in lowering the entrance ages, thus expanding the service of such centers and instituting training programs designed to prevent developmental deficits associated with cultural deprivation.

An ultimate extension of the study would involve the incorporation of a sub-nursery school program within the public school system. The logistics of home tutoring often pointed to the desirability of having the infants attend a central instructional facility where organized care and propitiously structured living-rountines would free the program from a number of typical in-domicile problems. The tutorial program for infants has made it evident that infants are capable of at least one hour a day of serious work, and that activities presented in small groups might be useful. It is entirely plausible for infants to attend "classes" for an entire school or working day, classes designed to offer physical care and a structured program of intellectual stimulation, constructive play, and socialization.

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