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ABSTRACT

This study tests two hypotheses: (1) prekindergarten children who are provided with a personalized program based on individual assessment of their developmental skills will increase their intellectual abilities and will learn at a higher level than children without this program, and (2) these same children will retain their acquired superiority through the first and second primary years. Subjects were 126 first and 103 second year children in matched experimental and control groups. Experimental and control groups were compared on pretests and posttests given each year of the experiment over a span of four years. Findings from the 1960-1970 phase of the experiment are reported along with the final four year findings (1967-1970). Both hypotheses were supported in part. At prekindergarten level, gains from personalized programming were consistent enough to point out that 4-year-old children had responded well to brief daily individualized sessions of work in game-like situations which were geared to development of sensory, language, motor, or cognitive skills. The positive effects did not carry over to the end of the following year. Although the experimental program made no long-range impact on girls, the cumulative impact on boys indicated they outperformed their control counterparts as well as the girls. Some supplementary studies of achievement are reported along with unanswered questions pertaining to children who evidenced developmental lags. (WY)

Final Report

Project No. 6-1328
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THE EFFECTS OF ASSESSMENT AND PERSONALIZED PROGRAMMING ON SUBSEQUENT INTELLECTUAL DEVELOPMENT OF PREKINDERGARTEN AND KINDERGARTEN CHILDREN

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J.M.D.
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SUMMARY

This final research study examined the subsequent progress of representative groups of experimental children who attended the Prekindergarten Experiment (1966-1967) and the Prekindergarten Field Test (1967-1968) and matched control groups who had not had this experience. The program of the experimental groups was augmented in 1968-1969 by teacher aides working with experimental children in kindergarten or in the first primary year. The present study compares the experimental and control groups with respect to achievement in the first and second primary years and intelligence in the middle of the first primary year. Two hypotheses were tested:

1. Prekindergarten children who are provided with a personalized program based on individual assessment of their developmental skills will increase their intellectual abilities, and will learn at a higher level than children without this program.

2. The same prekindergarten children will retain their acquired superiority through the first and second primary school years.

Findings for the 1969-1970 school year are reported together with a review of the results obtained during the previous three years of study.

Methods.

The skills development of more than 400 applicants to the prekindergarten experiment were assessed prior to the beginning of each prekindergarten year. Groups of these children were "matched" for age, intelligence, and language development to comprise comparable experimental and control groups who were representative of the local school population. After the first year, the developmental level of motor, auditory, visual, and language skills, or all skills intact, was used as a criterion for equating subgroups within the total groups. Due to attrition, the groups and subgroups were "rematched" each year before analysing pretest and posttest data. The present study includes a total of 126 first and 103 second primary year children in the experimental and control groups.

Instruments. Assessments of skill areas and intelligence were made as pre- and posttests during the first three years. Readiness and reading tests were administered in kindergarten. Intelligence and achievement tests were included at the first primary level, and an achievement test was used at the second primary level.

Methods of Analyses. Throughout the study, the statistical significance of differences between comparable experimental and control groups and subgroups was computed. Depending upon the nature of the data several procedures were employed including analyses of variance and covariance, t-tests, and the binomial test in Z form.

1969-1970 Achievement Findings.

Second Primary Level. The total experimental group of boys significantly excelled the total control group of boys in achievement measures of reading, vocabulary, spelling, and word study skills as shown by univariate F test and t-test analyses. An experimental subgroup of boys assessed by pretest as Weak Intact and Intact also excelled their control counterpart in achievement in reading, spelling, and language. The total control group of girls excelled the comparable experimental group in word reading. No significant subgroup differences were found for girls.

First Primary Level. In contrast to findings of primary one children for the previous year in which the total group of experimental boys excelled their control counterpart in word reading and paragraph meaning, the current data showed no statistically significant differences in achievement or intelligence test results between experimental and control groups or subgroups of either sex.

Supplementary Studies of Achievement. Varied findings in previous years and program follow-up using teacher aides in 1968-1969 motivated the study of program impact on three specific groups: 1. children scoring low in the auditory association skills pretest, 2. young children, and 3. black children. In those studies, experimental and control children were matched on pretest chronological age, auditory association skills (ITPA-3), and language quotient (ITPA-LQ).

1. Experimental children who scored in the lowest quartile on the pretest of auditory association obtained a significantly greater number of higher mean scores on achievement subtests than their control counterparts at the end of the first primary year. This was true of both sexes. The experimental children received a follow-up program using teacher aides during this same year. In addition, experimental boys achieved significantly higher than control boys in reading and in three related achievement measures as indicated by t-test analyses. Low experimental children who had a follow-up program at the kindergarten level only, showed no significant achievement differences with control children at the end of the first primary year.

2. Achievement of young children at the end of their first primary year showed that experimental boys excelled in reading, and experimental girls excelled in vocabulary, compared with their control counterparts as indicated by t-test analyses. In terms of frequency of higher mean subtest score, control girls in the first primary year in 1969-1970 excelled experimental girls at a significant level. However, experimental children, both boys and girls, in their first primary year in 1968-1969, and the same experimental children in their second primary year in 1969-1970, had a significantly greater frequency of higher mean scores than their "matched" control groups each year.

3. Achievement of black children at the end of the first primary year showed that experimental boys tested significantly higher than control boys in paragraph meaning, vocabulary, and word study skills as shown by t-test analyses. Experimental boys also excelled at a significant level their control counterparts in the frequency of higher mean scores obtained on achievement subtests. Between experimental and control girls, no statistically significant differences were found.

Four Year Findings - 1967-1970.

Only statistically significant differences between experimental and control groups and subgroups are reported.

Prekindergarten Experiment. In skills development, both boys and girls in the first group to attend prekindergarten made higher posttest scores and showed greater growth than control children with or without the usual nursery school experience. This advantage gained by the experimental group was not maintained by either sex at the end of kindergarten when no follow-up program was implemented. By the completion of the first primary year, experimental children, both boys and girls, surpassed their control counterparts in the development of certain skills and experimental boys excelled control boys in two subtests of reading achievement as well. During this period, teacher aides had been provided to work with experimental children in skills development and basic tool subjects. In the second primary year, reported on page 2, experimental boys continued to retain their superiority, excelling control boys significantly on four subtest measures of reading achievement. However, control girls for the first time surpassed experimental girls on one reading achievement subtest. No follow-up program was provided during this second primary year. In this four year period, the findings for experimental subgroups generally paralleled those of the total experimental group.

Prekindergarten Field Test. The second group to attend prekindergarten, benefitted even more than the first experimental group. Compared with the control group, experimental children of both sexes made higher posttest scores and showed greater growth in more skills areas than their predecessors of the previous year. This advantage in skills growth and development was maintained by experimental children of both sexes throughout kindergarten. Moreover, experimental girls surpassed control girls in reading and number readiness. These results show marked contrast with those of the first kindergarten group in which no significant skills development or readiness differences were found. A follow-up program was implemented during this kindergarten year. The following year, reported on page 2, no significant achievement differences between experimental and control groups were identified, and no follow-up program was provided. During this three year period, the findings for experimental subgroups generally were similar to those for the total experimental group.

Conclusions.

Major Study. The following conclusions are suggested by the findings:

Personalized programs were effective at the prekindergarten level.

Impact on achievement and developmental skills was greater at the kindergarten level when a follow-up program was implemented.

Impact on achievement and developmental skills was evidenced at the first primary level only when a follow-up program was implemented.

A carry-over effect on achievement was evidenced at the second primary level when a follow-up program was implemented at the first primary level only.

The program strengthened achievement of boys but was less effective for girls.

More impact was made on achievement in reading than in mathematics.

None of the programs studied revealed a long range effect upon intelligence as assessed in the first primary year.

In determining effect upon achievement, cognitively oriented programs proved to be more effective than sensory, motor, or language oriented programs.

Boys who had auditory-language deficits before beginning school and who participated in no prekindergarten program to ameliorate those deficits, lagged consistently behind their peers in achievement at the end of the second primary year. Program impact on boys with such deficits was revealed even though achievement level was low when compared with boys in general.

Paraprofessionals working with small groups of children, using materials planned by professionals, had a positive influence on the achievement of those children.

Boys who had participated in the program consistently outperformed girls in achievement at the second primary level.

Supplementary Studies. The three experimental subgroups which were identified for study were each positively affected by the reinforcement of personalized programming. Achievement was strengthened for those boys and girls who scored lowest on the ITPA Auditory Association during pretesting and for the youngest boys and girls. Black boys who participated in the programs showed a marked increase in achievement, but black girls failed to show similar progress.

Unanswered Questions. Many variables which were not investigated might have effected the results of the study, i.e., cultural and socio-economic backgrounds of the children, physiological problems, and age of the child when introduced to reading. How programs for young children can be funded and auxiliary personnel provided for follow-up activities remain two pressing problems hindering implementation of the program on a larger scale.

INTRODUCTION

This final report culminates a four year study of the effects of personalizing programs for prekindergarten children who were followed through the first or second primary years. A matched group of control children attended a number of nursery schools or did not attend school. The children were not exceptional, but represented a wide range of abilities and socio-economic levels among several ethnic groups, typical of the local public school enrollment. Following prekindergarten, both experimental and control children were enrolled in regular classes in one of the ten University City elementary schools. Except for program follow-up using teacher aides to work with experimental children in 1968-1969, similar experiences were provided to both groups. Results from the first three years are given in Interim Final Reports (1, 2, 3).

In this fourth and last year, the experimental and control groups have been designated as

Prekindergarten Experiment, Fourth Year or Second Primary Level

Prekindergarten Field Test, Third Year or First Primary Level.

Experimental and control groups were matched each year for age, sex, language, and intelligence measured by tests administered before the opening of the prekindergarten. The full test battery assessed performance in five developmental skills: motor, auditory, visual, language, and cognition. Major skills development needs also were considered in matching.

Program and Staff.

In prekindergarten, experimental children attended classes which met for two hours and forty-five minutes daily, five days a week, during the school year. The program focused on activities of a typical, well balanced curriculum which provided opportunity for social, physical, emotional, aesthetic, and cognitive growth. In addition, 20 minutes each day were devoted to specific skills of children identified by the test battery as lagging in one or more of the developmental skills, or as having all skills intact. Because of limited numbers of children with certain skill needs, the five groups were taught in four classes each year. One teacher and two teacher aides were responsible for each class of approximately 25 children. The Bibliography lists local resources pertaining to the theoretical overview of the program, specific developmental skills activities emphasized, and materials used by teachers and parents.

Following prekindergarten, experimental and control children engaged in comparable programs in regular kindergarten classes in one of the ten University City elementary schools. Classroom teachers were provided with the most recent complete posttest battery of 14

tests (2, 3) and suggested programs for each experimental child. For control children, teachers received the results of a short-form test battery (4, 5, 6, 7) using seven tests of the complete battery which had been administered to all entering kindergarten children together with program recommendations. The same procedure for experimental children was followed before they began their first and second primary years. Information about control children pertaining to developmental skills was not provided as no screening test was administered beyond kindergarten.

Revision of the short-form assessment battery continued through 1969-1970 (8, 9, 10) for use with future kindergarten entrants.

In some kindergartens, reading was introduced with the initial teaching alphabet (i.t.a.), the emphasis being on the association of a symbol with its corresponding sound. Reading using i.t.a. was provided in all first year primary classes during which time children usually made the transition to traditional orthography. Piaget-type activities to foster logical thinking were also introduced at the kindergarten level. In 1968-1969 teacher aides were provided twice a week to work with experimental children in kindergarten and in the first primary year. Individual needs determined the nature of this program follow-up. No special programs were added to the usual curriculum in primary one or two during the 1969-1970 school year. Figure 1 shows the sequence of testing and programs.

A number of research studies related specifically to this pre-kindergarten study. In reviewing previous research, Almy (11) concluded that intelligence is not fixed at birth but emerges as it is nurtured by appropriate experiences. From his own investigations into the research literature, Bloom (12) emphasized that early experience is of crucial importance in determining both the rate and the final level of development, and that one hour spent fruitfully with young children is worth hundreds of hours of remedial teaching of failing students in the upper grades. Other important studies were those of Hebb (13) who stressed the necessity of early perceptual development in laying the groundwork for cognitive development, Hunt (14) who highlighted the vital part experience plays in fostering intellectual growth, and deHirsch (15) who pointed to the importance of identifying poor risk children in time to help them. Still other research findings and literature emphasized the importance of specific skills development and the positive relationship of each skill to intellectual growth: motor-Kephart (16), multi-sensory-Montessori (17), visual-Frostig (18), cognitive-Piaget (19), and language-Vygotsky (20).

1966-1967	1967-1968	1968-1969	1969-1970
Prekindergarten EXPERIMENT			
TESTS* Pretest, October Posttest 1, May**			
	Kindergarten EXPERIMENT		
	TESTS Posttest 2, May** Metro. Read., May PROGRAM Reading in i.t.a. Piaget		
	Prekindergarten FIELD TEST	Primary One EXPERIMENT	
	TESTS Pretest, August Posttest I, May**	TESTS Posttest 3, May** CTMM, January Stanford I, May PROGRAM Reading in i.t.a. Aides for E group	
		Kindergarten FIELD TEST	Primary Two EXPERIMENT
		TESTS Posttest 2, May** Metro. Read., May PROGRAM Reading in i.t.a. Piaget Aides for E group	TESTS Stanford II, May
			Primary One FIELD TEST
			TESTS CTMM, January Stanford I, May PROGRAM Reading in i.t.a.

*See references (1, 2, 3) and Table 1, page 10, for lists of the tests used.

**Experimental and Control groups were given the complete battery of 14 tests. Test results of the 14 tests for E, 7 tests for C with program recommendations were provided to teachers prior to childrens beginning kindergarten and the first primary year.

Figure 1. Prekindergarten Experiment and Field Test, 1966-1970.

Project Objectives Related to Research.

Among the several project objectives, the two concerned with the present research were:

1. To foster increased intellectual development of prekindergarten and kindergarten children through a personalized program based on assessments of each child's developmental skills.

2. To report statistical data resulting from the study of comparisons of children who participated in the experimental prekindergarten with matched groups of those who did not participate.

Hypotheses.

Two hypotheses were tested during the four years of the study:

1. Prekindergarten children who are provided with a personalized program based on individual assessment of their developmental skills will increase their intellectual abilities, and will learn at a higher level than children without this program.

2. The same prekindergarten children will retain their acquired superiority through kindergarten and the first and second primary years.

This final report is concerned with the effects of the skills development program on achievement in the first and second primary years and on intelligence in the first primary year. Three supplementary studies of the achievement of selected groups also are reported.

METHODS

Longitudinal research studies, first of skills development, and later of "readiness", intelligence, and achievement have been conducted since the organization of prekindergartens in 1966-1967 and in 1967-1968. In this report, children included in these studies have been designated as:

1. Prekindergarten Experiment, Fourth Year or Second Primary Level

2. Prekindergarten Field Test, Third Year or First Primary Level.

Instruments.

Experimental (E) and Control (C) subgroups were "matched" for age (CA); major program need (Motor-M, Auditory-A, Visual-V, Language-L, Weak Intact-W, and Intact-I); Illinois Test of Psycholinguistic Abilities language quotient (ITPA-LQ); and Peabody Picture Vocabulary Test intelligence quotient (PPVT-IQ) determined prior to the opening of each prekindergarten year. Because of small numbers of children, in analyzing the present data, subgroups were combined: M with V, A with L, and W with I in both the first and second primary levels.

During the present school year, the California Short-Form Test of Mental Maturity (CTMM) administered in January 1970 and the Stanford Achievement Test, Primary I Battery (S-I) administered in May 1970 provided a total of nine test scores or dependent variables for primary one children; the Stanford Achievement Test, Primary II Battery (S-II) administered in May 1970 provided eight test scores for primary two children. These tests are listed in Table 1.

Table 1. Intelligence and Achievement Tests

PRIMARY ONE:	California Short-Form Test of Mental Maturity (CTMM)	
		Language I.Q. (L-IQ)
		Non-Language I.Q. (NL-IQ)
		Total I.Q. (TOT IQ)
	Stanford Achievement Test, Primary I Battery (S-I)	
		Word Reading (S-WR)
		Paragraph Meaning (S-PM)
		Vocabulary (S-V)
		Spelling (S-S)
		Word Study Skills (S-WSS)
		Arithmetic (S-A)
PRIMARY TWO:	Stanford Achievement Test, Primary II Battery (S-II)	
		Word Meaning (S-WM)
		Paragraph Meaning (S-PM)
		Science and Social Studies Concepts (S-SSS)
		Spelling (S-S)
		Word Study Skills (S-WSS)
		Language (S-L)
		Arithmetic Computation (S-ACom)
		Arithmetic Concepts (S-ACon)

Second Primary Level, Prekindergarten Experiment.

From among 277 representative four-year-old applicants for prekindergarten, more than 200 were selected in October 1966 for study. Two groups of children were "matched" separately by sex on language quotient (ITPA-LQ), intelligence (PPVT-IQ), and age at the time of pretest administration. The experimental group was designated by chance. Attrition necessitated rematching the E and C groups on the same variables, and the subgroups on these variables and on major skill development need determined at the time of pretesting. The subgroups were identified for purposes of data analysis as motor-visual (MV), auditory-language (AL), and weak and strong intact (WI). Table 2 shows the distribution of second year primary children.

Table 2. Distribution of Second Year Primary Children

Major Developmental Skill Need	BOYS		GIRLS	
	E	C	E	C
MV - Motor-Visual	8	12	9	14
AL - Auditory-Language	3	8	7	8
WI - Weak Intact and Intact	8	10	7	9
TOTAL	19	30	23	31

First Primary Level, Field Test.

More than 200 of 282 representative four-year-old applicants were selected in August 1967 for the Prekindergarten Field Test. E and C groups were "matched" separately by sex, on language quotient (ITPA-LQ), intelligence (PPVT-IQ), major skill development need, and age at the time of pretest administration. Again, the experimental group was designated by chance. A mobile population made rematching necessary in May 1970 on the same control variables. To increase the size of the subgroups for purposes of data analysis, skill subgroups were combined as motor-visual (MV), auditory-language (AL), and weak intact and intact (WI). Table 3 gives the distribution of E and C children by subgroup in the first primary year.

Table 3. Distribution of First Year Primary Children

Major Developmental Skill Need	BOYS		GIRLS	
	E	C	E	C
MV - Motor-Visual	6	7	11	11
AL - Auditory-Language	5	9	6	6
WI - Weak Intact and Intact	13	15	14	23
TOTAL	24	31	31	40

Methods of Analyses.

Univariate and t-test analyses were used to examine intelligence and achievement test data for the total experimental and control groups and for the experimental and control subgroups, separately by sex. In certain instances, a binomial test in Z form was computed also to ascertain whether or not a statistically significant difference in terms of the frequency with which the higher mean score favored the E or C group.

RESULTS

Findings are reported separately by sex for the Prekindergarten Experiment, Fourth Year or Second Primary Level and the Prekindergarten Field Test, Third Year or First Primary Level. For both levels, results are given for the total experimental (E) and total control (C) groups and for the experimental and control skills development subgroups designated as Motor-Visual (MV), Auditory-Language (AL), and Weak Intact and Intact (WI). Three substudies of achievement of selected groups are also reported.

Prekindergarten Experiment, Fourth Year Second Primary Level

Control Variables.

Univariate analyses of control variables, for Primary II children--age in months (CA), language quotient (ITPA-LQ), and intelligence (PPVT-IQ)--showed no significant differences between experimental and control children of either sex for the total groups (E, C) or between E and C subgroups (MV, AL, WI). F tests are reported in Appendix A, means are listed in Appendix B.

Dependent Variables.

Findings for Boys. Significant univariate F tests and t-tests ($p < .05$) between total E and C groups were found in four subtests of the Stanford Achievement Test--Word Meaning, Paragraph Meaning, Spelling, and Word Study Skills. These findings, given in Table 4, all favored experimental boys. At the time of testing, grade placement was 2.9 or nine tenths of the school year through the second grade. Mean grade equivalent scores for the total E group had a subtest range from 3.72 or .82 school years above grade placement to 4.84 or 1.94 school years above actual grade on these four subtests. Differences favoring the total experimental group ranged from .60 to 1.07 school years. Univariate F tests ($p < .05$ or $p < .025$) identified three subtests for possible significant differences between the E and C subgroups. Appropriate t-tests ($p < .05$) showed these differences to

favor experimental Weak Intact and Intact (WI) boys on Paragraph Meaning, Spelling, and Language. Mean grade equivalent scores on these three subtests for the WI subgroups of E and C respectively were: Paragraph Meaning (4.20, 3.16), Spelling (3.89, 2.81), and Language (4.41, 3.27) favoring the E subgroup. Differences ranged from 1.04 to 1.14 g.e. showing experimental WI boys to be more than one year advanced in achievement than their control counterparts. Complete data are provided in Appendix C.

Table 4. Significant Achievement Grade Equivalent Univariate F Tests with Corresponding Means and t-Tests for Second Year Primary Boys

STANFORD SUBTEST	df for F	F	MEAN G. E.		Mean Diff.	df for t	t
			Exper.	Control			
BETWEEN TOTAL EXPERIMENTAL AND CONTROL GROUPS							
Word Meaning	1/47	4.13*	4.03	3.43	.60	47	2.03*
Paragraph Meaning	1/47	4.52*	3.84	3.21	.63	47	2.12*
Spelling	1/47	4.99*	3.72	2.99	.73	47	2.23*
Word Study Skills	1/47	4.17*	4.84	3.77	1.07	47	2.04*
BETWEEN COMBINED WEAK INTACT AND INTACT EXPERIMENTAL AND CONTROL SUBGROUPS							
Paragraph Meaning	1/43	5.55**	4.20	3.16	1.04	16	2.12*
Spelling	1/43	6.60**	3.89	2.81	1.08	16	2.13*
Language	1/43	4.76*	4.41	3.27	1.14	16	2.40*

Significance Level: * $p < .05$
** $p < .025$

A comparison of grade equivalent means in Appendix C for the subgroups and the total groups of experimental and control boys point to the strengths of the Weak Intact-Intact (WI) experimental subgroup and the comparative weaknesses of the Auditory-Language (AL) subgroups. The experimental WI subgroup consistently excel their control counterparts and all other experimental and control subgroups and total groups in terms of frequency of higher mean scores on the Stanford subtests. The experimental and control AL subgroups were consistent in frequency of lower mean scores when compared with all

other groups and subgroups and the control AL subgroup was consistently lower than the experimental AL subgroup. In general, mean achievement scores of boys were well above actual grade level (2.9 g.e.). No total experimental or control group scored below 2.9. The total experimental group of boys not only surpassed their control counterparts in achievement, but also had consistently higher mean scores than either the total experimental or control groups of girls. However, the total control group of boys showed consistently lower mean scores than the total control group of girls.

Findings for Girls. Only one significant univariate F test and t-test ($p < .05$) between total E and C was found. This difference favored control girls in Word Meaning by .47 g.e., or slightly less than one half a school year. Both E and C groups achieved above actual grade placement by .47 and .94 grade equivalent points respectively on this subtest. Table 5 gives these findings. No other differences between E and C total groups or subgroups of girls was statistically significant. In general, mean achievement scores of girls were well above actual grade level (2.9 g.e.). No experimental group or subgroup had a mean score below 3.1 g.e. Only one control subgroup of girls showed a mean score below 2.9 g.e. Appendix C provides complete data.

Table 5. Significant Achievement Grade Equivalent Univariate F Tests with Corresponding Means and t-Tests for Second Year Primary Girls

STANFORD SUBTEST	df for F	F	MEAN G.E. Exper.	MEAN G.E. Control	Mean Diff.	df for t	t
BETWEEN TOTAL EXPERIMENTAL AND CONTROL GROUPS							
Word Meaning	1/52	4.03*	3.37	3.84	-.47	52	2.008*

Significance Level: *$p < .05$

Prekindergarten Field Test, Third Year
First Primary Level

Control Variables.

Univariate analyses of control variables for Primary I children--age in months (CA), language quotient (ITPA-LQ), and intelligence (PPVT-IQ)--showed no significant differences between the experimental and control groups of either sex for the total group (E, C) or subgroups (MV, AL, WI). F tests are given in Appendix A, means are listed in Appendix B.

Dependent Variables.

Findings. In contrast to Primary I boys the previous year, univariate F tests revealed no statistically significant differences between total E and C groups or E and C subgroups (MV, AL, WI) for either sex on the subtests of the Stanford Achievement Test. In 1968-1969, however, the total group of E boys excelled their control counterparts on two subtests of the Stanford Achievement Test and Intact experimental boys surpassed the comparable control subgroup on one Stanford subtest at statistical levels of confidence. No significant differences in the achievement of girls was found in either year. Univariate F tests and mean grade equivalent scores for the present study are provided in Appendix D.

On the California Test of Mental Maturity, univariate F tests showed no statistically significant differences between experimental and control groups or subgroups of either sex in 1968-1969 or in 1969-1970. Appendix E gives F tests and mean I.Q. scores obtained in the present study.

Supplementary Studies of Achievement of Prekindergarten Experiment and Field Test Children

The varied findings for groups, subgroups, boys, and girls, and program follow-up using teacher aides in kindergarten and the first primary year in 1968-1969, prompted an examination of program impact on specific groups. Supplementary studies focused on the subsequent achievement of three groups: 1. children who scored low on the auditory association pretest, 2. young children, and 3. black children. In each study, experimental and control groups were "matched" on pretest chronological age (CA), Auditory Association (ITPA-3), and language quotient (ITPA-LQ). In equating the groups, ITPA-3 was substituted for the Peabody Picture Vocabulary Test (PPVT-IQ) as ITPA-3 and ITPA-LQ in three previous studies (21, 22, 23) were found to correlate much more highly with achievement than the PPVT-IQ formerly used in matching.

Children Scoring Low on the Auditory Association Pretest: Achievement in the First Primary Year.

The high correlation of the Auditory Association pretest with achievement pointed to this test as an excellent criterion by which to predict low achieving children in later years. Although ranking below 75 percent of their classmates, in auditory association skills, both experimental and control groups tested on the average only one-half standard deviation below the mean on national norms, and only 20 percent of them fell below one standard deviation which indicates a serious deficit.

During 1968-1969, teacher aides worked in a follow-up program with experimental children in kindergarten and in the first primary year in program follow-up. Control children did not receive this instruction. Both experimental and control children were given the Stanford Achievement Test at the end of their first primary year.

That the groups were equated is shown by t-tests in Table 6. Results from the Stanford Achievement Test given at the end of the first primary year are shown separately by sex. Significance was determined both by t-test and by the binomial test in Z form.

Program Follow-Up in Kindergarten. As shown in Table 6, when teacher aides worked with low experimental kindergarten children, no significant differences were found at the end of the first primary year. In Word Reading, experimental and control boys obtained the same mean grade equivalent of 2.28, the mean grade equivalent for E girls was 2.48, for C girls it was 2.20. The mean g.e. difference of .28 indicates the superiority of E girls by approximately two and eight-tenths months of the school year, but this figure is not significant as indicated by the t-test of t = .66, ns. The remaining subtest figures also are interpreted in this manner. In all, E boys had higher mean scores on one subtest, C boys were higher on four subtests. This 1 to 4 ratio applied to the binomial test in Z form, Table 7, showed Z = .81 which was not statistically significant. In comparing E and C girls the ratio of 5 to 1 gave Z = 1.63, and this figure also was not significant.

Program Follow-Up in the First Primary Year. When teacher aides worked with low experimental children during the year in which the Stanford Achievement Test was given, results show impact for both sexes but more for boys than girls. The t-test analyses, Table 6, show experimental boys scoring significantly higher than their control counterparts on four of the six Stanford subtests: Paragraph Meaning, Vocabulary, Spelling, and Word Study Skills. No significant difference between E and C girls was identified by t-test analyses. Applying the binomial test in Z form to E with C boys and E with C girls, the ratio of the higher mean grade equivalent was 6 to 0 for both sexes with Z = 2.44 as given in Table 7. This figure gives $p < .0146$ indicating less than 146 in 10,000 possibility the difference occurred by chance.

Table 6. Control Variables and Stanford Achievement Test Grade Equivalents of Low Experimental Children Receiving Teacher Aide Assistance and Matched Control Groups

VARIABLE	BOYS Mean E	BOYS Mean C	BOYS Diff.	BOYS t	GIRLS Mean E	GIRLS Mean C	GIRLS Diff.	GIRLS t
TEACHER AIDES IN KINDERGARTEN								
CONTROL								
Age	50.50	50.83	- .33	.17^{ns}	50.29	50.50	- .21	.09^{ns}
ITPA-LQ	99.33	95.83	3.50	.36^{ns}	97.14	94.75	2.39	.41^{ns}
ITPA-3-AA	7.83	7.83	.00	.00^{ns}	9.00	7.71	1.29	.73^{ns}
STANF-I								
S-WR	2.28	2.28	.00	.00^{ns}	2.48	2.20	.28	.66^{ns}
S-PM	1.98	2.00	- .02	.06^{ns}	2.38	2.10	.28	.60^{ns}
S-V	2.33	2.66	- .33	.59^{ns}	2.28	2.17	.11	.23^{ns}
S-S	2.18	2.48	- .30	.90^{ns}	2.65	2.00	.65	1.48^{ns}
S-WSS	2.23	2.66	- .43	.90^{ns}	3.12	3.50	- .38	.35^{ns}
S-A	2.13	2.06	.07	.20^{ns}	2.27	2.00	.27	.70^{ns}
Ave. G.E.	2.19	2.36	- .17		2.53	2.33	.20	
No. of Children	6	6	--		7	4	--	
TEACHER AIDES IN PRIMARY ONE								
CONTROL								
Age	52.60	52.44	.16	.07^{ns}	52.00	51.33	.67	.28^{ns}
ITPA-LQ	88.20	90.00	-1.80	.24^{ns}	97.00	96.33	.67	.07^{ns}
ITPA-3-AA	6.80	7.44	- .64	.54^{ns}	7.75	7.33	.42	.26^{ns}
STANF-I								
S-WR	2.92	2.11	.81	2.14^{ns}	2.42	2.33	.09	.25^{ns}
S-PM	2.82	1.66	1.16	4.21**	2.15	1.95	.20	.55^{ns}
S-V	2.30	1.76	.53	2.21*	2.42	1.85	.57	1.91^{ns}
S-S	2.84	2.08	.76	3.36**	2.57	2.26	.31	.94^{ns}
S-WSS	4.00	2.08	1.92	3.69**	3.75	2.96	.79	1.01^{ns}
S-A	2.24	1.83	.41	1.60^{ns}	2.17	1.82	.35	1.71^{ns}
Ave. G.E.	2.85	1.92	.93		2.58	2.20	.38	
No. of Children	5	9	--		4	9	--	

ns - not statistically significant
* $p < .05$
** $p < .01$

Table 7. Binomial Tests in Z Form of the Achievement of Low Experimental and Control Children

VARIABLE	BOYS				GIRLS			
	Frequency of Higher Mean		Z	Significance	Frequency of Higher Mean		Z	Significance
	E	C			E	C		
TEACHER AIDES IN KINDERGARTEN								
Stanford Ach. Test, Pri. I Battery	1	4	.81	ns*	5	1	1.63	ns*
TEACHER AIDES IN PRIMARY ONE								
Stanford Ach. Test, Pri.II Battery	6	0	2.44	<.0146	6	0	2.44	<.0146

* ns-not statistically significant.

Young Children: Achievement in the First and Second Primary Years.

The youngest experimental and control children, approximately 25 percent, in first primary year (1969-1970) and in the first and second primary years (1968-1969, 1969-1970), were "matched" on pretest chronological age, language quotient (ITPA-LQ), and Auditory Association score (ITPA-3). This latter test was used as in the previous study, page 15, because it correlated more highly with achievement than the Peabody Picture Vocabulary Test I.Q., previously used in matching. Subtest grade equivalent scores of the Stanford Achievement Test, Primary I Battery (1968-1969 and 1969-1970) and Primary II Battery (1969-1970) were examined separately. Data were analyzed by sex, first, for 16 experimental and 18 control children in the first primary year, and second for 13 experimental and 21 control children in the second primary year for whom first year primary data also were available. Both t-tests and the binomial test in Z form were used in these analyses.

First Primary Year. Table 8 provides experimental and control mean grade equivalent scores, score differences and t-tests for the control variables and for each subtest of the Stanford Achievement Test. The larger mean score is underlined. The figures indicate no significant differences between the groups in control variables or on any of the six Stanford subtests for either sex as determined by t-tests. However, applying the binomial test in Z form, Table 9 showed

that control girls surpassed experimental girls in frequency of higher mean scores on the Stanford subtests with $p < .0146$. The mean grade equivalent difference was .39 (Table 8), giving control girls slightly less than four months achievement advantage.

Table 8. Control Variables and Stanford Achievement Test Grade Equivalents of Young Children Tested at the End of Their First Primary Year of the Prekindergarten Field Test

	BOYS				GIRLS			
	MEAN				MEAN			
VARIABLE	E	C	Diff.	t	E	C	Diff.	t
CONTROL								
Age	47.86	48.33	- .47	$.81^{ns}$	48.00	48.67	- .67	1.10^{ns}
ITPA-LQ	104.43	104.89	- .46	$.05^{ns}$	111.78	111.78	.00	$.00^{ns}$
ITPA-3-AA	10.57	11.00	- .43	$.29^{ns}$	12.22	13.00	.78	$.51^{ns}$
STANF. I								
S-WR	2.27	2.18	.09	$.27^{ns}$	2.52	2.65	- .13	$.52^{ns}$
S-PM	1.98	1.84	.14	$.57^{ns}$	2.26	2.84	- .58	1.78^{ns}
S-V	2.94	2.67	.27	$.53^{ns}$	2.88	2.98	- .10	$.17^{ns}$
S-S	2.37	2.56	- .19	$.62^{ns}$	2.57	2.60	- .03	$.07^{ns}$
S-WSS	2.64	2.63	.01	$.01^{ns}$	3.02	4.15	-1.13	1.72^{ns}
S-A	2.44	2.23	.21	$.75^{ns}$	2.18	2.55	- .37	1.18^{ns}
Ave. G. E.	2.44	2.35	.09		2.57	2.96	- .39	
No. of Children	7	9	--		9	9	--	

ns - not statistically significant.

Table 9. Binomial Tests in Z Form of the Achievement of Young Experimental and Control Children in the First Primary Year, 1969-1970

VARIABLE	B O Y S				G I R L S			
	Frequency of Higher Mean		Z	Signif-icance	Frequency of Higher Mean		Z	Signif-icance
	E	C			E	C		
Stanford Ach. Test, Pri. I Battery	5	1	1.63	ns	0	6	2.44	<.0146

ns - not statistically significant.

First and Second Primary Years. Table 10 gives mean grade equivalent scores, score differences, and t-tests for the control variables and for the Stanford Achievement Test, Primary I and II subtests. A significant difference between experimental and control groups was found in two instances. In the first primary year, experimental boys surpassed control boys in Paragraph Meaning at a statistically significant level ($t = 2.24$) with an achievement advantage of six and six-tenths months. First year experimental girls surpassed control girls in Vocabulary at a significant level ($t = 2.36$) with an advantage of nine and one-half months.

In the second primary year, no statistically significant differences between E and C groups of either sex were identified by t-tests. Figures are given in Table 10.

Again, applying the binomial test in Z form to the data given in Table 10, four significant differences, all favoring the experimental groups, were identified. The figures are reported in Table 11. In their first primary year (1968-1969), experimental children of both sexes made higher mean grade equivalent scores than their control counterparts on all six Stanford subtests. This ratio of 6 to 0 in each instance ($Z = 2.44$) was significant at $p < .0146$ level indicating less than a two percent possibility the results occurred by chance. In their second primary year (1969-1970), results for these same children also favored the experimental groups. For boys, a ratio of 7 to 0 ($Z = 2.12$) was significant at $p < .034$; for girls, an 8 to 0 ratio ($Z = 2.82$) was significant at $p < .0047$.

Table 10. Control Variables and Stanford Achievement Test Grade Equivalents of Young Children Tested at the End of Their First and Second Primary Years of the Prekindergarten Experiment

VARIABLE	BOYS MEAN E	BOYS MEAN C	BOYS Diff.	BOYS t	GIRLS MEAN E	GIRLS MEAN C	GIRLS Diff.	GIRLS t
CONTROL								
Age	49.80	49.38	- .42	.82^{ns}	48.86	49.07	- .21	.64^{ns}
ITPA-LQ	100.00	102.00	-2.00	.28^{ns}	109.57	106.36	3.21	.54^{ns}
ITPA-3-AA	8.80	9.25	- .45	.24^{ns}	10.29	11.07	- .78	.44^{ns}
FIRST PRIMARY YEAR								
STANF. I								
S-WR	2.96	2.22	.74	1.76^{ns}	2.68	2.44	.24	.72^{ns}
S-PM	2.46	1.80	.66	2.24*	2.53	2.03	.50	1.28^{ns}
S-V	2.86	2.41	.45	.91^{ns}	2.98	2.03	.95	2.36*
S-S	2.70	2.21	.49	1.45^{ns}	2.73	2.37	.36	1.25^{ns}
S-WSS	3.98	2.93	1.05	1.25^{ns}	3.93	2.90	1.03	1.73^{ns}
S-A	2.22	2.15	.07	.23^{ns}	2.20	1.96	.24	1.20^{ns}
Ave. G.E.	2.86	2.29	.57		2.84	2.29	.55	
SECOND PRIMARY YEAR								
STANF. II								
S-WM	3.66	3.06	.60	1.29^{ns}	3.55	3.32	.23	.61^{ns}
S-PM	3.32	2.82	.50	.71^{ns}	3.35	2.97	.38	.81^{ns}
S-SSS	3.64	3.12	.52	.67^{ns}	3.67	2.83	.84	1.89^{ns}
S-S	3.82	3.28	.54	.59^{ns}	3.31	3.15	.16	.38^{ns}
S-WSS	4.18	3.94	.24	.24^{ns}	4.28	3.19	1.09	1.51^{ns}
S-L	3.52	3.33	.19	.18^{ns}	3.92	3.40	.52	1.18^{ns}
S-ACom	2.76	2.78	.00	.00^{ns}	3.05	2.64	.41	1.40^{ns}
S-ACon	3.26	2.85	.41	.58^{ns}	3.52	2.82	.70	1.41^{ns}
Ave. G. E.	3.52	3.15	.37		3.58	3.04	.54	
No. of Children	5	8	--		7	14	--	

ns - not statistically significant.
* $p < .05$

Table 11. Binomial Tests in Z Form of the Achievement of the Same Young Experimental and Control Children in the First and Second Primary Years

VARIABLE	BOYS				GIRLS			
	Frequency of Higher Mean		Z	Significance	Frequency of Higher Mean		Z	Significance
	E	C			E	C		
FIRST PRIMARY YEAR - 1968-1969								
Stanford Ach. Test, Pri. I Battery	6	0	2.44	<.0146	6	0	2.44	<.0146
SECOND PRIMARY YEAR - 1969-1970								
Stanford Ach. Test, Pri. II Battery	7	0	2.12	<.034	8	0	2.82	<.0047

Black Children: Achievement in the First Primary Year.

In the third investigation, the mean grade equivalent scores of black children obtained at the end of the first primary year on the Stanford Achievement Test were examined. Because of small numbers the 1968-1969 and 1969-1970 figures were combined. E and C children were "matched" separately by sex on pretest chronological age (CA), Auditory Association (ITPA-3), and language quotient (ITPA-LQ). ITPA-3 was used for the reason given in the study of low children, page 15. Table 12 gives the results.

No significant differences were found between groups of either sex on the control variables, with the exception of control boys who were significantly older than experimental boys at the <.01 level of confidence. In achievement, however, experimental boys excelled control boys by .26 to 1.55 grade equivalent points on all six subtests. The .26 represents an advantage of approximately two and one-half months, 1.55 represents an advantage of slightly more than one and one half years in achievement. In terms of t-test analyses, E boys excelled their counterparts in Paragraph Meaning, Vocabulary, and Word Study Skills at $p < .01$, $p < .05$, and $p < .02$ levels of significance respectively.

Experimental girls excelled control girls on three achievement subtests, control girls excelled experimental girls on two achievement subtests, and no difference between groups was found on one subtest. None of these differences was significant at a statistical level of confidence.

Table 12. Achievement of Black Children
at the End of the First Primary Year
(Grade Equivalent Scores for 1968-1969 and 1969-1970 Combined)

	BOYS				GIRLS			
	MEAN				MEAN			
VARIABLE	E	C	Diff.	t	E	C	Diff.	t
CONTROL								
Age	49.43	54.64	-5.21	3.42^{***}	53.20	54.33	1.13	$.50^{ns}$
ITPA-LQ	101.86	96.27	5.59	$.84^{ns}$	110.20	103.33	6.87	$.53^{ns}$
ITPA-3-AA	9.57	9.82	.25	$.18^{ns}$	11.2	11.17	.03	$.00^{ns}$
STANF-I								
S-WR	2.80	2.10	.70	2.06^{ns}	2.50	2.63	- .13	$.36^{ns}$
S-PM	2.93	1.71	.72	3.21^{***}	2.20	2.32	- .12	$.23^{ns}$
S-V	3.01	2.21	.80	2.15^{*}	2.40	2.40	.00	$.00^{ns}$
S-S	2.53	2.27	.26	1.27^{ns}	2.76	2.33	.43	1.28^{ns}
S-WSS	3.84	2.29	1.55	2.75^{**}	3.48	3.02	.46	$.49^{ns}$
S-A	2.24	1.85	.39	1.94^{ns}	2.28	1.95	.33	$.97^{ns}$
No. of Children	7	11	--		5	6	--	

* $p < .05$
** $p < .02$
*** $p < .01$
ns - Not statistically significant.

In terms of a binomial analysis in Z form, Table 13 shows that experimental boys scored higher than control boys on all six subtests of the Stanford Achievement Test, a frequency difference significant at the $p < .0146$ level of confidence. Experimental girls scored higher on three and control girls scored higher on two Stanford subtests. The frequency differences for girls were not significant.

Table 13. Binomial Tests in Z Form of the
Achievement of Black Children

	BOYS				GIRLS			
	Frequency of Higher Mean				Frequency of Higher Mean			
VARIABLE	E	C	Z	Significance	E	C	Z	Significance
Stanford Ach. Test, Pri. I Battery	6	0	2.44	<.0146	3	2	.00	ns

Four Year Findings - 1967-1970

Group Comparisons.

Significant findings for the total groups of experimental and control children for the Prekindergarten Experiment and the Prekindergarten Field Test are summarized in Table 14. Developmental skills were assessed at the end of the prekindergarten year for both Experiment and Field Test children. Developmental skills and achievement were assessed for both groups at the end of kindergarten. For children in the Experiment, developmental skills, achievement, and intelligence were assessed at the end of the first primary year, but achievement only was examined at the end of the second primary year. For the Field Test children, intelligence and achievement were assessed in the first primary year. Field Test children had not reached the second primary year in 1969-1970. For each developmental skills test battery administered, posttest and growth (posttest minus pretest) differences between experimental and control groups were examined. Achievement and intelligence tests, varying in content and grade level, provided no growth measure. Descriptive information pertaining to the test instruments or levels of confidence of specific significant differences may be found in the three interim reports (1, 2, 3).

Posttest Comparisons,
Prekindergarten Experiment, Total Groups.

Findings for Boys. The total experimental group of boys in the Experiment at the end of the second primary year scored significantly higher than the corresponding control group on four achievement subtests (word meaning, paragraph meaning, spelling, and word study skills). These results surpassed those of the previous year when experimental boys scored higher only on two achievement subtests (word reading and paragraph meaning), and on a test of motor skills. At the end of the kindergarten year, there were no significant differences between experimental and control boys in developmental skills or achievement. At the end of prekindergarten, experimental boys surpassed control boys with nursery school experience in four measures of developmental skills (a composite of psycholinguistic skills, visual association, verbal expression, and motor coordination). They also surpassed control boys with no school experience on five measures of developmental skills (a composite of psycholinguistic skills, visual association, verbal expression, visual-motor integration, and motor coordination). Control boys with nursery school experience surpassed experimental boys on one test of developmental skill (auditory memory).

Findings for Girls. There was one significant difference in achievement at the end of the second primary year. In this instance, girls in the total control group surpassed experimental girls in word reading. At the end of the first primary year, there were no significant differences in achievement or intelligence and only one developmental skill difference, favoring total experimental girls in

visual-motor integration. At the end of kindergarten, there were no significant differences between total experimental and control groups in developmental skills or achievement. At the end of prekindergarten, experimental girls surpassed control girls with and without nursery school experience on three measures of developmental skills (verbal expression, visual-motor integration, and motor coordination).

Growth (Posttest Minus Pretest) Comparisons, Prekindergarten Experiment, Total Groups.

Findings for Boys. The total experimental group of boys in the Experiment at the end of the first primary year, showed greater growth than the corresponding control group in three measures of developmental skills (composite of psycholinguistic skills, non-verbal expression, and motor coordination). No significant growth differences were found at the end of the kindergarten year. However, at the end of prekindergarten, experimental boys showed greater growth than control boys with nursery school experience on both measures of expression (verbal and non-verbal). At the end of prekindergarten, four growth differences between experimental and control boys without school experiences (composite psycholinguistic skills, visual association, verbal expression, and non-verbal expression) favored the experimental group.

Findings for Girls. The total experimental group of girls in the Experiment at the end of the first primary year, showed greater growth than the corresponding control group in one developmental skill (visual-motor integration), but no skill differences were found at the end of kindergarten. At the end of prekindergarten, three growth differences were found between experimental and control girls with nursery school experience (picture vocabulary, verbal expression, and visual-motor integration). Eight growth differences were found between experimental and control girls without school experiences at the end of prekindergarten (composite of psycholinguistic skills, picture vocabulary, auditory reception, verbal expression, non-verbal expression, visual memory, visual-motor integration, and motor coordination). In each instance, the growth differences favored the experimental girls.

Posttest Comparisons, Prekindergarten Field Test, Total Groups.

Findings for Boys. The total experimental and control groups of boys in the Field Test showed no significant difference in achievement at the end of the first primary year or at the end of kindergarten. However, at the end of the kindergarten, experimental boys surpassed control boys in two developmental skills (verbal expression and visual-motor integration). At the end of the prekindergarten year, experimental boys also surpassed the control boys in six measures of developmental skills (composite of psycholinguistic skills, visual association, verbal expression, grammatic closure, visual-motor integration, and motor coordination).

Table 14. Analyses of Skills Development and Achievement Test Findings in which One Group Significantly Excelled its Matched Counterpart

VARIABLE/ GROUP	PREKINDERGARTEN		KINDERGARTEN		PRIMARY I		PRIMARY II	
	Post.	Growth	Post.	Growth	Post	Growth	Post.	Growth
PREKINDERGARTEN EXPERIMENT								
	1966 - 1967		1967 - 1968		1968 - 1969		1969 - 1970	
SKILL-s					AIDES			
Boys	4s E>Cn 5s E>Co 1s Cn>E	2s E>Cn 4s E>Co	ns	ns	1s E>	3s E>	*	*
Girls	3s E>Cn 3s E>Co	3s E>Cn 8s E>Co	ns	ns	1s E>	1s E>	*	*
ACHIEVE-MENT-a					AIDES			
Boys	*	*	ns	**	2a E> (1a E>)	**	4a E>	**
Girls	*	*	ns	**	ns	**	1a C>	**
PREKINDERGARTEN FIELD TEST								
	1967 - 1968		1968 - 1969		1969 - 1970			
SKILL-s			AIDES					
Boys	6s E>	5s E>	2s E>	4s E>	*	*		
Girls	6s E>	8s E>	4s E>	4s E>	*	*		
ACHIEVE-MENT-a			AIDES					
Boys	*	*	ns	**	ns	**		
Girls	*	*	2s E> (1a E>)	**	ns	**		

NOTE:
Results obtained by F tests and t-tests except as noted.
( ) Binomial test in Z form.
> E>, significantly greater than its counterpart.
* No assessment made.
** Posttest minus pretest growth not measured.
s Skills development assessments.
a Achievement tests.
ns No significant differences.

Findings for Girls. The total experimental and control groups of girls in the Field Test at the end of the first primary year showed no difference in achievement. However, at the end of kindergarten, experimental girls surpassed the corresponding control group in ability to identify a sound with a symbol and in number readiness. No assessment of developmental skills was made at the end of the first primary year. At the end of kindergarten, experimental girls surpassed the control girls in four measurements of developmental skills (composite of psycholinguistic skills, auditory reception, non-verbal expression, and visual-motor integration). At the end of prekindergarten, experimental girls surpassed control girls in six measures of developmental skills (a composite of psycholinguistic skills, picture vocabulary, visual reception, verbal expression, visual-motor integration, and motor coordination).

Growth (Posttest Minus Pretest) Comparisons, Prekindergarten Field Test, Total Groups.

Findings for Boys. The total experimental group of boys in the Field Test at the end of kindergarten showed greater growth than the corresponding control group in four measures of developmental skills (a composite of psycholinguistic skills, visual reception, verbal expression, and visual-motor integration). At the end of the prekindergarten year, growth differences favoring experimental boys were found in five skills measures (a composite of psycholinguistic skills, visual association, verbal expression, grammatic closure, and motor coordination).

Findings for Girls. The total experimental group of girls in the Field Test at the end of kindergarten showed greater growth than their control counterparts in four measures of developmental skills (a composite of psycholinguistic skills, auditory reception, non-verbal expression, and visual-motor integration). At the end of the prekindergarten, growth differences favoring the experimental girls were found in eight skills measures (a composite of psycholinguistic skills, picture vocabulary, auditory association, visual association, verbal expression, visual memory, visual-motor integration, and motor coordination).

Summary of Findings for Total E and C Groups.

For total groups, more differences in developmental skills were found at the end of the prekindergarten year for children in both the Experiment and Field Test than during any subsequent year. When a follow-up program for Field Test children using teacher aides was introduced at the kindergarten level, experimental children of both sexes excelled their control counterparts in developmental skills and achievement. No significant differences between experimental and control children in the Experiment were found in either developmental skills or achievement when no follow-up program in kindergarten was provided. However, at the end of the first primary year with a

follow-up program, experimental children in the Experiment did surpass control children in developmental skills, and experimental boys also excelled in achievement. No follow-up program was provided for the first year primary Field Test group, and no differences were found between experimental and control at this level. At the end of the second primary year, experimental boys in the Experiment maintained their achievement superiority found at the end of the first primary year and also gained in two additional areas of achievement even though the follow-up program was not continued. At the end of the second primary year, the only achievement difference favoring a control group was found.

Subgroup Comparisons.

Significant findings of the subgroups of experimental and control children for the Experiment and Field Test are summarized in Table 15. The following coding system is used to aid in the identification of the respective subgroup: m-motor deficit; a-auditory deficit; v-visual deficit; l-language deficit; w-skills intact, weak; i-skills intact, strong; E-experimental; C-control. The subgroup coding is based on the pretest identification of the deficit. For each developmental skills test battery administered, posttest and growth (posttest minus pretest) differences between corresponding experimental and control subgroups were examined. Achievement and intelligence tests, varying in content and grade level, provided no growth measure. The Experiment children were analyzed by subgroup only in the first and second primary years. The Field Test children were analyzed by subgroup each year.

Posttest Comparisons,
Prekindergarten Experiment, Subgroups.

Findings for Boys. At the end of the second primary year, the Ewi subgroup of boys surpassed the Cwi subgroup on three achievement subtests (paragraph meaning, spelling, and language). No assessment of development skills was made in the second primary year. At the end of the first primary year, the Ei subgroup of boys surpassed the Ci subgroup in one achievement subtest (paragraph meaning) and all experimental subgroups consistently surpassed their control counterparts in terms of high mean scores on all achievement subtests. Also at the end of the first primary year, two experimental subgroups (Em, Ev) surpassed their control counterparts in one developmental skill (motor coordination). No subgroup analysis was made at the end of the kindergarten or the prekindergarten years.

Findings for Girls. At the end of the first primary year, the Eal subgroup of girls surpassed the Cal subgroup in one developmental skill (visual-motor integration). Two subgroups consistently surpassed their corresponding counterparts in terms of higher mean scores on all achievement subtests: the Em being higher than Cm and Cv being higher than Ev.

Table 15. Analyses of Skills Development and Achievement Test Findings in which One Subgroup Significantly Excelled its Matched Counterpart

VARIABLE/ GROUP	PREKINDERGARTEN		KINDERGARTEN		PRIMARY I		PRIMARY II	
	Post.	Growth	Post.	Growth	Post.	Growth	Post.	Growth
PREKINDERGARTEN EXPERIMENT								
	1966 - 1967		1967 - 1968		1968 - 1969		1969 - 1970	
SKILL-s					AIDES			
Boys	*	*	*	*	1s Em> 1s Ev>	2s Ei> 2s Ev> 1s En>	*	*
Girls	*	*	*	*	1s Eal>	ns	*	*
ACHIEVE-MENT-a					AIDES			
Boys	*	*	*	**	1a Ei> (1a Em>) (1a Eal>) (1a Ev>) (1a Ei>)	**	3a Ewi>	**
Girls	*	*	*	**	(1a Em>) (1a Cv>)	**	ns	**
PREKINDERGARTEN FIELD TEST								
	1967 - 1968		1968 - 1969		1969 - 1970			
SKILL-s			AIDES					
Boys	2s Ei> 2s El> 1s Em> 1s Ew>	3s El> 1s Ew>	1s Ema> 1s Ei> 1s Cv>	1s Ema> 1s El> 1s Ei>	*	*		
Girls	2s Ew> 1s Em> 1s Ei>	3s Em> 2s Ew> 1s El>	1s Ema> 1s Ei>	2s Ei>	*	*		
ACHIEVE-MENT-a			AIDES					
Boys	*	*	1a Ev>	**	ns	**		
Girls	*	*	2a Ev>	**	ns	**		

NOTE:
Results obtained by F tests and t-tests except as noted.
( ) Binomial test in Z form.
> E>, significantly greater than its counterpart.
* No assessment made.
** Posttest minus pretest growth not measured.
s Skills development assessments.
a Achievement tests.
ns No significant differences.

Growth (Posttest Minus Pretest) Comparisons, Prekindergarten Experiment, Subgroups.

Findings for Boys. At the end of the first primary year, three experimental subgroups showed greater growth than their control counterparts. The Ei subgroup of boys demonstrated more growth than the Ci subgroup in two developmental skills (non-verbal expression and motor coordination). The Ev subgroup showed more growth than the Cv subgroup in two measures of developmental skills (a composite of psycholinguistic skills and auditory association). The Em subgroup of boys grew more than the Cm subgroup in one measurement of developmental skill (motor coordination).

Findings for Girls. No growth differences were found in developmental skills between experimental and control subgroups in the first primary year, the only year this analysis was made.

Posttest Comparisons, Prekindergarten Field Test, Subgroups.

Findings for Boys. At the end of the kindergarten year, the Ev subgroup surpassed the Cv subgroup in one achievement subtest (readiness test of copying). Three subgroups showed superiority in developmental skills. Both Ei and Ema subgroups surpassed their control counterparts in visual-motor integration. The Cv subgroup surpassed the Ev subgroup in visual closure. At the end of the prekindergarten year, four experimental subgroups demonstrated superiority in developmental skills. The Ei subgroup surpassed the Ci subgroup in two skills (a composite of psycholinguistic skills and non-verbal expression). The El subgroup surpassed the Cl subgroup in two skills (a composite of psycholinguistic skills and verbal expression). The Em subgroup surpassed the Cm subgroup in visual-motor integration. The Ew subgroup surpassed the Cw subgroup in motor coordination.

Findings for Girls. At the end of the kindergarten year, one experimental subgroup surpassed the corresponding control group in two measures of achievement and two experimental subgroups surpassed their control counterparts in one developmental skill each. The Ev subgroup excelled in ability to identify symbols with sounds and in a readiness test of matching. The Ema subgroup surpassed the Cma subgroup in visual-motor integration, and the Ei subgroup surpassed the Ci subgroup in auditory reception. At the end of the prekindergarten year, three experimental subgroups showed superiority in certain developmental skills. The Ew subgroup surpassed the Cw subgroup in visual-motor integration and verbal expression. The Em subgroup surpassed the Cm subgroup in motor coordination. The Ei subgroup surpassed the Ci subgroup in a composite of psycholinguistic skills.

Growth (Posttest Minus Pretest) Comparisons, Prekindergarten Field Test, Subgroups.

Findings for Boys. At the end of the kindergarten year, three experimental subgroups in the Field Test showed greater growth in certain developmental skills than their control counterparts. The Ei subgroup grew more than the Ci subgroup in a composite of psycholinguistic skills. The El subgroup grew more than the Cl subgroup in verbal expression, and the Ema subgroup grew more than the Cma subgroup in visual-motor integration. At the end of prekindergarten, two experimental subgroups of boys had shown more growth than their control counterparts. The El subgroup showed greater growth than the Cl subgroup in a composite of psycholinguistic skills, in verbal expression, and in motor coordination. The Ew subgroup also showed greater growth than the Cw subgroup in motor coordination.

Findings for Girls. At the end of the kindergarten year, the Ei subgroup showed greater growth than the Ci subgroup in two measures of developmental skills (a composite of psycholinguistic skills and auditory reception). At the end of prekindergarten, three experimental subgroups showed greater growth than their control counterparts in certain developmental skills. The Em subgroup showed more growth than the Cm subgroup in measures of composite of psycholinguistic skills, auditory association, and motor coordination. The Ew subgroup showed more growth than the Cw subgroup in measures of composite of psycholinguistic skills and verbal expression. The El subgroup showed more growth than the Cl subgroup in auditory association.

Summary of Findings for E and C Subgroups.

For Field Test children, more differences in developmental skills favoring experimental subgroups were found at the end of prekindergarten than during the subsequent year. Differences favoring experimental subgroups were found at the end of the kindergarten year when a follow-up program implemented by teacher aides was provided for experimental Field Test children. No subgroup analyses were made for Experiment children in prekindergarten or kindergarten.

For Experiment children at the end of the first primary year in which experimental children received a follow-up program, experimental boys surpassed their corresponding control subgroups in achievement. Two achievement differences were found for girls, one favoring an experimental subgroup and one favoring a control subgroup. In the second primary year, experimental boys not only maintained but increased their advantage over control boys while no differences were found for girls between subgroups. Subgroup findings closely followed total group findings with significant differences appearing the same year that a follow-up program was implemented.

CONCLUSIONS

Findings supported, in part, the first hypothesis that prekindergarten children who are provided with a personalized program based on individual assessment of their developmental skills will increase their intellectual abilities, and will learn at a higher level than children without this program.

Findings also supported, in part, the second hypothesis that the same prekindergarten children will retain their acquired superiority through the first and second primary school years.

Experiment and Field Test Studies.

At the prekindergarten level, the impact of the personalized developmental skills program was apparent and consistent for experimental children in both the Experiment and Field Test. The findings pointed up the positive manner in which four year old children after one prekindergarten year had responded to brief, daily, individualized sessions of work in game-like situations which were geared to the development of specific sensory, language, motor, or cognitive skills.

Conclusive as the results of the prekindergarten year seemed, they did not, on their own, prove to be strong enough to produce a carry-over effect to the end of the following year for the children in the Experiment. The importance of a follow-up program was clearly indicated as experimental Field Test children, in kindergarten, with reinforcement only twice a week maintained their superiority at the end of the kindergarten year. However, the results for this Field Test group were no longer visible at the end of the first primary year during which no specific programming was implemented.

Results of the study suggest that the personalized, small group program of reinforcement is most important for boys during the first primary year. With such a program, boys not only excelled in word and paragraph comprehension, but were able to maintain this superiority without a follow-up program during the second primary year, and at the same time, excel in spelling and word study skills.

The success of the follow-up programs emphasized the importance of trained paraprofessionals as a part of the team of school personnel working to meet individual educational needs of young children.

The program appeared to have made no long-range impact on the achievement or intelligence levels of girls in general. To be effective over time, girls might need a reinforcement program for two consecutive years following prekindergarten, or, as girls are thought to mature earlier than boys, they might benefit by starting school experiences earlier.

Results from the study suggest a positive relationship over time between developmental skills and achievement for boys. They did not indicate the same relationship between developmental skills and intelligence either for boys or girls.

During the study, differences both in reading and number readiness occurred. However, greater impact seemed to have been made on achievement in reading than on achievement in mathematics.

In examining the results at the end of the second primary year for the subgroups of boys with no skills deficits on pretest before the prekindergarten year, it seemed clear that the cognitively oriented program made the greatest long-range impact on achievement. Experimental children with no developmental lags on pretests participated in cognitively oriented prekindergarten and follow-up programs. Experimental boys not only surpassed their control counterparts in achievement, but were also consistently higher than all other experimental and control subgroups and experimental and control total groups on every measure of achievement. Control boys with no developmental lags on pretests showed no evidence of similar progress.

The results at the end of the second primary year for the subgroups of boys with auditory-language deficits on pretests before the prekindergarten year, clearly pointed to the realization that these boys made less progress in achievement than any other subgroups of boys studied. However, the impact of the program was noticeable, as boys lagging in auditory-language development who participated in the developmental skills activities consistently surpassed boys with the same developmental lag who did not participate.

The cumulative impact of the program on boys was so great that not only did the experimental boys consistently outperform their control counterparts but they even outperformed girls in both the experimental and control groups.

Supplementary Studies of Achievement.

The cumulative impact of a follow-up program with experimental children in the first primary year who scored in the lowest quartile on an auditory association pretest in prekindergarten, which correlated highly with achievement, was positively indicated. Low scoring experimental boys achieved significantly higher in reading and related skills and experimental children of both sexes excelled in achievement in terms of the frequency of higher mean scores than the corresponding control groups. Low scoring children not experiencing the follow-up program during the first primary year did not show similar progress.

Findings from a study of the youngest children revealed an impact upon girls at the first primary level if a reinforcement program was implemented. The findings were duplicated at the end of the second primary year. Once again, the small group work seemed to be a major factor in influencing results, as without such work, findings favored young control girls.

Black experimental children responded in general as the total experimental group, boys showing positive differences, girls showing none. However, black boys showed superiority in more facets of reading achievement than the total group, as they excelled in vocabulary and word study skills as well as in paragraph comprehension at the end of the first primary year. The comparison of mean grade equivalent scores pointed up a wider gap between black experimental children and corresponding control children than between total experimental and control groups, as black experimental boys showed a year and a half advantage over black control boys in word study skills, eight months in vocabulary, and seven months in paragraph comprehension.

Unanswered Questions.

The subgroup of children which had auditory and language deficits included a variety of problems such as impoverished language background, bilingual home environment, articulation problems, and poor auditory discrimination. Because the auditory and language problems of children pointed to such a variety of cultural and physiological causations and because this subgroup was consistently lower in achievement than motor, visual or cognitive subgroups, earlier and more specific attention may need to be paid to children with these specific developmental lags. In comparison with the other subgroups which achieved well above grade level, the auditory and language subgroups did sufficiently less well to suggest that some system of reading other than the initial teaching alphabet (i.t.a.) might prove more effective in teaching these children.

Other researchers have reported the positive relationship of socio-economic factors to achievement. This factor was not considered in the equating of groups in this study and its influence in relationship to achievement results is unknown.

If there are critical ages for the introduction of specific learning tasks, the use of aides might therefore have greater impact at one age than another, and this timing might be different for boys than it is for girls.

Another unknown is the impact of the effort to build self-esteem which was made during the prekindergarten year, and reinforced by the follow-up programs. In view of the results of the Experiment and Field Test research, the need for positive verbal reward for tasks successfully completed might have been met for girls in the typical classroom, but not met as well for boys.

A greater emphasis on personalizing instruction for all children, experimental and control, also might have weakened the results of the study. Some of this emphasis was generated by the project itself as a short form of the assessment battery was used with all children before entering kindergarten, and the results, together with program recommendation for each child, were in the hands of the teacher before

the school year started. Teachers have also participated in an early education workshop series which focused on methods, materials, and techniques for meeting individual needs. All materials and guides used by the aides in the follow-up programs were available to the teachers for use in their classrooms.

Apart from questions directly related to the research, the problem of continuing the prekindergarten without federal, state, or local funding is a difficult one. Beginning in the 1968-1969 school year, the prekindergarten has been self-supporting, operating on a tuition basis. However, even with this prekindergarten and two additional facilities, a Title I prekindergarten, and a Head Start Center, less than one third of the district's four-year-old children are being reached.

The financial feasibility of hiring additional personnel presents another question at a time when most public schools are beset with severe budget problems. Locating and training interested volunteers might be a solution to maintaining the follow-up facet of the program in small group situations which this study showed to be extremely influential in making a decisive impact on later achievement of young children.

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DEVELOPMENTAL COMPONENTS SPECIFICALLY PROGRAMMED

I. Development of Motor Skills

- A. Awareness of Self
- B. Gross Motor
- C. Fine Motor
- D. Position in Space
- E. Eye-Motor
- F. Creative Motor

DEVELOPMENTAL COMPONENTS SPECIFICALLY PROGRAMMED (continued)

II. Sensory Development (Tactile, Auditory, Visual)

- A. Perceptual Awareness
- B. Perceptual Matching
- C. Perceptual Discrimination
- D. Comprehension and Interpretation

III. Cognitive Development

- A. Symbolism
- B. Classification
- C. Conservation
- D. Seriation
- E. Spacial Relationships
- F. Temporal Relationships

IV. Language Development

- A. Language Patterns
- B. Accurate Expression
- C. Creative Expression
- D. Sounds with Symbols
- E. Speech Improvement

APPENDIX A

Univariate Analyses of Control Variables

Control VARIABLE	BOYS			GIRLS		
	df	F	Sig.	df	F	Sig.
SECOND PRIMARY YEAR - TOTAL GROUPS E, C						
Age in Months	1/47	.43	ns*	1/52	.03	ns
ITPA L.Q.	1/47	.23	ns	1/52	.32	ns
PPVT I.Q.	1/47	.33	ns	1/52	.29	ns
SECOND PRIMARY YEAR - SUBGROUPS MV, AL, WI						
Age in Months	1/43	.40	ns	1/48	.03	ns
ITPA L.Q.	1/43	.34	ns	1/48	.42	ns
PPVT I.Q.	1/43	.46	ns	1/48	.27	ns
FIRST PRIMARY YEAR - TOTAL GROUPS E, C						
Age in Months	1/53	.38	ns	1/69	.00	ns
ITPA L.Q.	1/53	.11	ns	1/69	.14	ns
PPVT I.Q.	1/53	.00	ns	1/69	.00	ns
FIRST PRIMARY YEAR - SUBGROUPS MV, AL, WI						
Age in Months	1/49	.36	ns	1/65	.00	ns
ITPA L.Q.	1/49	.20	ns	1/65	.22	ns
PPVT I.Q.	1/49	.00	ns	1/65	.01	ns

*Not statistically significant.

APPENDIX B

Means of Control Variables

Variable	Sub-Group/ Total	BOYS Mean E	BOYS Mean C	GIRLS Mean E	GIRLS Mean C
SECOND PRIMARY YEAR - SUBGROUPS AND TOTAL GROUPS					
Age in Months	MV	54.50	53.42	52.33	51.86
	AL	53.00	53.63	52.86	52.25
	WI	54.25	53.40	54.00	54.78
	Total	54.16	53.47	53.00	52.81
ITPA L.Q.	MV	108.00	108.58	105.33	107.14
	AL	86.67	87.50	100.29	101.75
	WI	116.88	117.10	117.00	119.67
	Total	108.37	105.80	107.35	109.39
PPVT I.Q.	MV	106.88	110.67	104.44	103.29
	AL	102.00	90.88	104.29	102.88
	WI	117.38	118.00	108.14	106.44
	Total	110.53	109.63	105.52	104.10
FIRST PRIMARY YEAR - SUBGROUPS AND TOTAL GROUPS					
Age in Months	MV	52.17	53.00	52.91	52.00
	AL	51.20	51.33	52.83	52.17
	WI	51.92	52.87	51.93	52.83
	Total	51.83	52.45	52.45	52.50
ITPA L.Q.	MV	107.00	107.71	104.36	104.36
	AL	88.80	91.78	97.17	96.50
	WI	119.46	118.53	121.93	120.26
	Total	109.96	108.32	110.90	112.33
PPVT I.Q.	MV	107.17	112.86	106.45	102.36
	AL	100.00	98.22	98.83	98.50
	WI	110.85	111.33	112.43	113.13
	Total	107.67	107.87	107.68	107.98

APPENDIX C

Univariate Analyses and Mean Grade Equivalent Scores of Dependent Achievement Variables for Second Year Primary Children

STANFORD TEST	Group	BOYS F Total Group	BOYS F Sub-Groups	BOYS E	BOYS C	BOYS Diff.	GIRLS F Total Group	GIRLS F Sub-Groups	GIRLS E	GIRLS C	GIRLS Diff.
WM	MV		6.29**	4.03	3.98	.05		5.06*	3.28	3.64	- .36
	AL			2.87	2.35	.52			3.17	3.28	- .11
	WI			4.46	3.62	.84			3.67	4.67	-1.00
	Tot.	4.13*		4.03	3.43	.60	4.03*		3.37	3.84	- .47
PM	MV		5.55**	3.85	3.75	.10		.24ns	3.71	3.42	.29
	AL			2.83	2.46	.37			3.40	2.90	.50
	WI			4.20	3.16	1.04			3.93	4.22	- .39
	Tot.	4.52*		3.84	3.21	.63	.22ns		3.68	3.55	.13
SSSC	MV		2.53ns	4.05	4.42	- .37		.28ns	3.32	3.68	- .36
	AL			2.93	2.09	.84			3.24	3.18	.06
	WI			4.48	3.94	.54			3.84	3.90	- .06
	Tot.	1.41ns		4.05	3.64	.41	.28ns		3.46	3.61	- .15
SP	MV		6.60**	4.04	3.70	.34		1.41ns	3.21	3.50	- .29
	AL			2.43	2.14	.29			3.14	3.45	- .31
	WI			3.89	2.81	1.08			3.60	3.91	- .31
	Tot.	4.99*		3.72	2.99	.73	1.46ns		3.31	3.61	- .30
WSS	MV		4.91*	5.23	4.62	.61		1.98ns	4.07	3.68	.39
	AL			3.03	2.50	.53			4.86	3.31	1.55
	WI			5.13	3.77	1.36			4.70	4.53	.17
	Tot.	4.17*		4.84	3.77	1.07	2.01ns		4.50	3.83	.67
LANG	MV		4.76*	3.76	3.84	- .08		.10ns	3.59	3.52	.07
	AL			2.97	2.21	.76			3.73	3.14	.59
	WI			4.41	3.27	1.14			3.84	4.22	- .38
	Tot.	3.85ns		3.91	3.22	.69	.09ns		3.71	3.63	.08
A-CP	MV		.23ns	2.90	3.33	- .43		1.94ns	3.10	2.95	.15
	AL			2.50	2.29	.21			3.10	2.76	.34
	WI			3.48	3.10	.38			3.39	3.22	.17
	Tot.	.19ns		3.08	2.97	.11	1.92ns		3.19	2.98	.21
A-CC	MV		3.58ns	4.10	3.73	.37		.65ns	3.40	3.45	- .05
	AL			2.63	2.08	.55			3.77	2.90	.87
	WI			4.60	3.87	.73			3.79	3.74	.05
	Tot.	2.93ns		4.08	3.33	.75	.66ns		3.63	3.39	.24

Significance Level: * $p < .05$
** $p < .025$
ns - not statistically significant.

APPENDIX D

Univariate Analyses and Mean Grade Equivalent Scores of Dependent Achievement Variables for First Year Primary Children

STAN-FORD TEST	Group	BOYS F Total Group	BOYS F Sub-Groups	BOYS E	BOYS C	BOYS Diff.	GIRLS F Total Group	GIRLS F Sub-Groups	GIRLS E	GIRLS C	GIRLS Diff.
WR	MV		1.30^{ns}	2.45	2.47	-.02		.25^{ns}	2.78	2.75	.03
	AL			2.48	2.04	.44			2.57	2.18	.39
	WI			2.75	2.67	.08			2.87	2.83	.04
	Tot.	1.20^{ns}		2.62	2.44	.18	.24^{ns}		2.78	2.71	.07
PM	MV		.67^{ns}	1.85	2.06	-.21		.00^{ns}	2.92	2.46	.46
	AL			2.02	1.87	.15			2.25	2.07	.18
	WI			2.58	2.33	.25			2.78	3.05	-.27
	Tot.	.60^{ns}		2.28	2.14	.14	.00^{ns}		2.73	2.74	-.01
VOC	MV		.01^{ns}	2.48	3.37	-.89		.26^{ns}	2.92	2.69	.23
	AL			2.64	2.19	.45			2.28	2.23	.05
	WI			3.56	3.61	-.05			4.08	3.67	.41
	Tot.	.01^{ns}		3.10	3.14	-.04	.20^{ns}		3.32	3.19	.13
SP	MV		1.39^{ns}	2.48	2.51	-.03		.32^{ns}	2.83	2.60	.23
	AL			2.10	2.26	-.16			2.73	2.25	.48
	WI			2.52	2.84	-.32			2.80	2.91	-.11
	Tot.	1.27^{ns}		2.43	2.60	-.17	.30^{ns}		2.80	2.73	.07
WSS	MV		.08^{ns}	2.83	3.21	-.38		.01^{ns}	3.62	3.94	-.32
	AL			2.36	2.72	-.36			3.45	2.75	.70
	WI			3.89	3.93	-.04			4.43	4.35	.08
	Tot.	.08^{ns}		3.31	3.42	-.11	.01^{ns}		3.95	4.00	-.05
AR	MV		.87^{ns}	2.50	2.51	-.01		.18^{ns}	2.47	2.31	.16
	AL			2.54	1.90	.64			2.45	2.40	.05
	WI			2.83	2.92	-.09			2.66	2.84	-.18
	Tot.	.69^{ns}		2.69	2.53	.16	.18^{ns}		2.55	2.63	-.08

Significance Level:
^{ns}Not statistically significant.

APPENDIX E

Univariate Analyses and Mean I.Q. Scores of Dependent Intelligence Test Variables for First Year Primary Children

CALIFORNIA TEST	Group	BOYS					GIRLS				
		F Total Group	F Sub-Groups	E	C	Diff.	F Total Group	F Sub-Groups	E	C	Diff.
L-IQ	MV		.02^{ns}	117.2	114.6	2.6		1.17^{ns}	110.3	104.4	5.9
	AL			104.6	106.9	-2.3			115.3	111.0	4.3
	WI			117.4	120.3	-2.9			123.1	117.6	5.5
	Tot.	.01^{ns}		114.5	115.1	- .6	1.06^{ns}		116.8	113.0	3.8
NL-IQ	MV		2.11^{ns}	114.0	119.4	-5.4		.03^{ns}	116.9	112.5	4.4
	AL			119.4	101.8	17.6			114.6	116.4	-1.8
	WI			120.5	116.7	3.8			123.8	124.1	- .3
	Tot.	1.95^{ns}		118.8	113.0	5.8	.03^{ns}		119.3	119.8	- .5
Tot-IQ	MV		.72^{ns}	116.8	118.9	-2.1		.40^{ns}	114.4	109.2	5.2
	AL			112.0	104.9	7.1			116.7	114.4	2.3
	WI			121.1	119.4	1.7			126.2	122.8	3.4
	Tot.	.66^{ns}		118.2	115.1	3.1	.35^{ns}		119.9	117.9	2.0

Significance Level:
^{ns}Not statistically significant.