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ABSTRACT

To help assess the potential long term benefits of prekindergarten programs in the Austin Independent School District (AISD) since 1976, this report reviews compensatory early childhood education research findings. Part One summarizes findings from AISD's Chapter 1 Migrant, and Title VII prekindergarten programs. AISD students showed impressive gains across the year and across programs on the Peabody Picture Vocabulary Test-Revised. Part Two reviews the general literature on long term effects emphasizing the research of the Consortium for Longitudinal Studies, especially its Perry Preschool Project. The most important findings are: (1) good preschool programs can cut later special education placement rates in half; (2) preschool consistently reduces retention rates; (3) effects on achievement test scores last through fifth grade and favor children with preschool experience; (4) in the one study following participants through high school, 55 percent of control children but only 35 percent of preschool children were later dropouts; (5) IQ scores show very strong short-term effects; (6) preschool experience improves motivation and behavior during elementary school; (7) the Perry Project cost-benefit analysis showed that savings from reduced special education and retention costs alone enable a preschool program to pay for itself. (BS)

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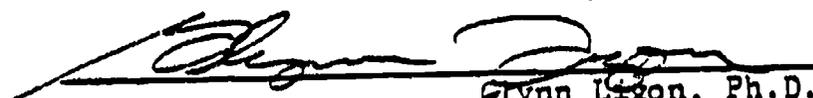
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EARLY CHILDHOOD EDUCATION -
THE BEST THING GOING IN EDUCATION?

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PREFACE

In recent years ORE has documented impressive fall-to-spring gains among four-year-olds participating in AISD's Chapter 1, Chapter 1 Migrant, and Title VII Early Childhood Education programs. Adequate assessment of potential long-term effects has not yet been possible, however, because there has not been enough information available to enable specification of an appropriate comparison group. In particular, it has not been possible to match a comparison group on initial cognitive ability because AISD does not test nonprekindergarten participants until the fall of kindergarten. Also, the programs have not been in existence long enough for very long-range data to be available.

To assess the potential long-term benefits of prekindergarten, therefore, we conducted an extensive review of the research literature available from studies across the nation. Many studies of compensatory early childhood education have had sound experimental designs and have collected years of follow-up information; the results indicate that well-done early childhood programs can have a significant effect on a child's entire educational career and possibly beyond. Furthermore, an economic cost-benefit analysis of one successful project showed that a program can more than pay for itself through reduced costs for special education and retention and through increased lifetime earning power of participants.

This report contains two parts. The first describes results obtained in studies of AISD's early childhood programs; the second summarizes the research literature nationwide.

TABLE OF CONTENTS

Preface 1

Summary 2

Part 1 - Summary of AISD Early Childhood Evaluation Findings . . . 3

Part 2 - Summary of Nationwide Research on Longterm Effects of Early
Childhood Education 8

EARLY CHILDHOOD EDUCATION: THE BEST THING GOING IN EDUCATION?

Research findings concerning compensatory early childhood education are reviewed in this special report. Part 1 summarizes findings from AISD's Chapter 1, Chapter 1 Migrant, and Title VII prekindergarten programs. These have typically found very impressive fall-to-spring gains on the Peabody Picture Vocabulary Test-Revised. However, available information does not permit assessment of possible long-term effects.

Part 2 is a review of the research literature on long-term effects, with emphasis on results reported by the Consortium for Longitudinal Studies. The most important findings are:

- A well-designed and run preschool program can cause the rate of later special education placement to be cut approximately in half.
- Preschool consistently reduces retention rates, although the effect is smaller than for special education placement.
- Effects on achievement test scores, while not large, consistently favor children with preschool experience. This effect in general lasts through fifth grade, though one study found that preschool children's advantage increased through eighth grade.
- The only study to follow participants to the end of high school found that 55% of control children but only 35% of preschool children later dropped out of school.
- IQ scores show very strong short-term effects. While these do not last beyond early elementary school, they seem to produce early success experiences and a positive attitude toward school. These effects in turn contribute to greater success in school.
- Children who have preschool experience have shown increased motivation and improved classroom conduct and personal behavior during elementary school.
- A cost-benefit analysis of one successful program has found that the savings from reduced special education and retention costs alone can enable a project to pay for itself. When other benefits such as increased lifetime earnings (resulting from more school success) are considered, one year of preschool has been shown to be equivalent to an investment receiving 9.5% interest over several decades.

PART 1 - SUMMARY OF AISD
EARLY CHILDHOOD EVALUATION FINDINGS

SUMMARY OF AISD EARLY CHILDHOOD EVALUATION FINDINGS

In brief -

- . Across the prekindergarten year and across programs, students on the average make excellent achievement gains.
- . Longitudinal data available indicate by grade 1 former pre-K students have lost their achievement advantage over similar students who did not attend pre-K (except for LEP students). There is some evidence this advantage may be reappearing by the end of grade 3.

Figure 1 presents a history of the various AISD programs, their funding sources, years of operation, and criteria for selecting students to participate in the programs.

The first evaluation efforts occurred in 1976-77 when the Migrant Evaluator looked at the completion rates and mastery tests of the curriculum used at that time. Generally speaking, the majority of the units were completed/mastered by nearly all the students. No achievement measures were administered that year. Beginning in 1977-78, the Tests of Basic Experience (TOBE) was given. The Migrant prekindergarten students made, on the average, a year's gain in six months. These same levels of gain were repeated for both Title I and Migrant pre-K students in 1978-79. In 1979-80, for the first time the TOBE gains were compared for Title I and Migrant students, with both groups averaging good gains, but with Title I students showing higher gains as a group.

In 1980-81, the evaluation switched to the Peabody Picture Vocabulary Test (PPVT) to measure gains for Title I, Migrant, and the new Title VII pre-K programs. All three groups showed good gains over the year with Title I students doing the best (as a group) and Title VII students showing the lowest gains of the three groups. In 1981-82 and 1982-83 the revised version of the PPVT (PPVT-R) was used to measure achievement in all three programs. In both years, Title I (Chapter 1) students made the greatest gains as a group. However, both years all three programs produced substantial achievement gains. See Figure 2.

Since 1978-79 longitudinal data have been collected on former pre-K students. The numbers of students with scores at each grade level are quite small in some cases so the longitudinal data should be interpreted with caution. Across all programs and years, students in early childhood programs have shown good achievement at the end of their prekindergarten year. Compared to similar students entering kindergarten, the former Title I (Chapter 1) and Migrant students score higher on the achievement test given at the beginning of kindergarten. However, their advantage has been lost by the beginning of grade 1. This advantage has not re-appeared by the end of grade 1 or 2. These 1978-79 pre-K students were in grade 3 in 1982-83 and the achievement data from the end of grade 3 suggest that the former pre-K students may be regaining some of their lost advantage.

In examining the scores of the former 1980-81 Title VII pre-K students who were LEP and comparing them with similar LEP students who did not attend pre-K, the former pre-K students showed an achievement advantage at both the beginning and end of kindergarten. At the end of grade 1 in 1982-83 these former pre-K students continued to show some achievement advantage in the area of reading.

<u>FUNDING SOURCE</u>	<u>MIGRANT</u>	<u>TITLE I/CHAPTER 1</u>	<u>TITLE VII</u>	<u>LOCAL BILINGUAL</u>	<u>LOCAL (like Chapter 1)</u>
<u>YEAR</u>	1973-74 and continuing through present	1978-79 and continuing through present	1980-81 through 1982-83	1983-84	1983-84
<u>CRITERIA FOR STUDENT PARTICIPATION</u>	Eligible Migrant student (Class size is currently 16.)	School has to rank as one with high percentage of low-income students. Then students are screened via a screening test and those with the lowest scores are those selected for the program. (Class size is currently 16.)	Students who had Spanish listed on their home language survey and who scored 79 or lower on the English PAI were eligible. Students meeting these qualifications were then randomly selected for the program. Three non-LEP students who scored high on the English PAI were also in each class to serve as role models. (Class size was 18.)	Students who are considered LEP are eligible and those who scored the lowest on the PAI were chosen. Two non-LEP students who scored high on the English PAI were also in each class to serve as role models. (Class size is 16.)	Follows same guidelines as Chapter 1. (Class size is 16.)

Figure 1. HISTORY OF AISD PREKINDERGARTEN/EARLY CHILDHOOD PROGRAMS

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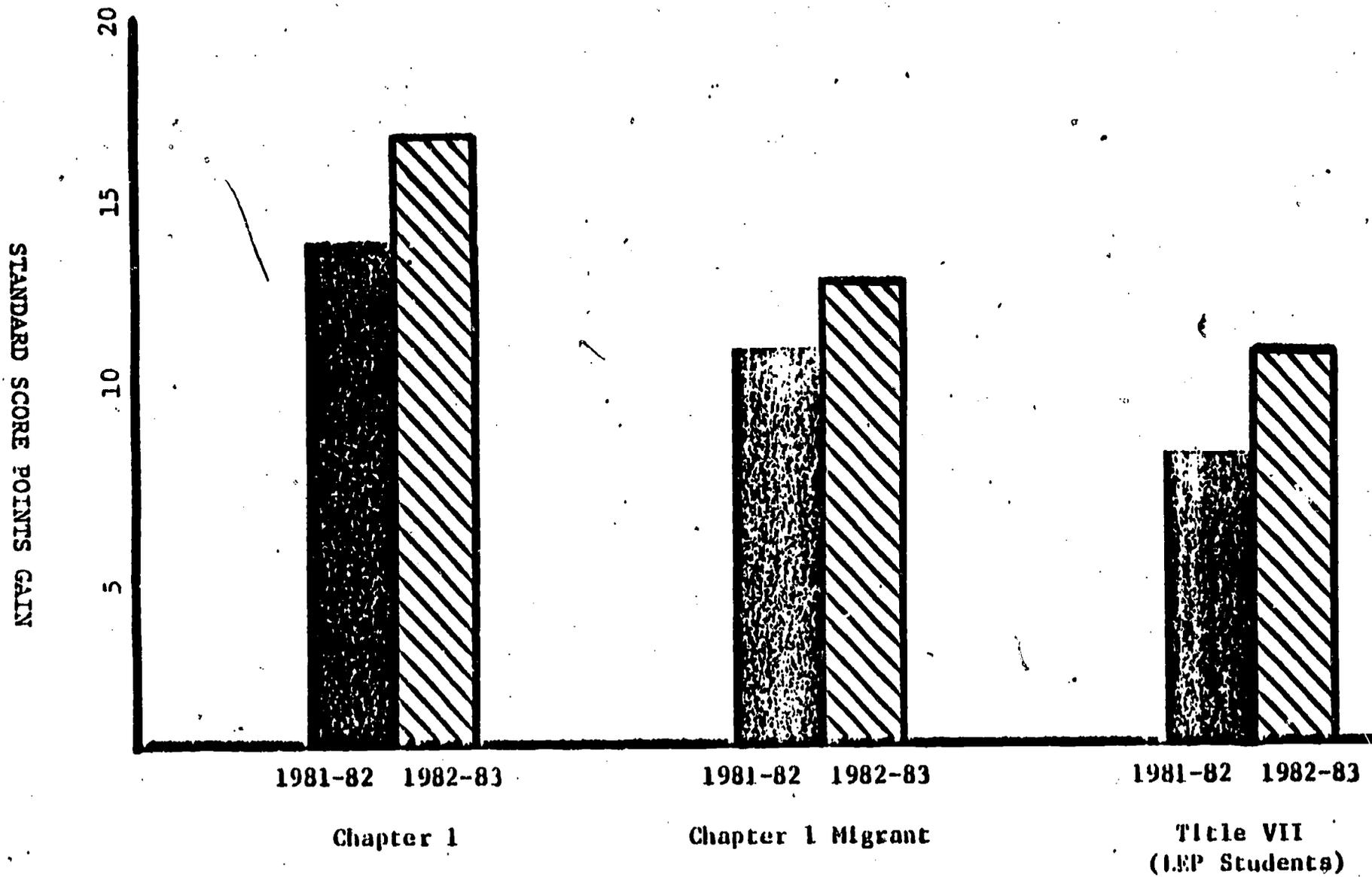


Figure 2.

COMPARISONS OF THE PRE-TO POSTTEST GAINS ON THE PEABODY PICTURE VOCABULARY TEST - REVISED FOR, 1981-82 AND 1982-83, BY AISD EARLY CHILDHOOD PROGRAMS.

Follow-up will continue on former students from all the early childhood programs. The selection criteria for the programs has been quite different so comparisons of gains across the programs should be made keeping these differences in mind.

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PART 2 - SUMMARY OF NATIONWIDE
RESEARCH ON LONGTERM EFFECTS OF EARLY
CHILDHOOD EDUCATION

Long-Term Effects of Early Childhood Education

The efficacy of preschool education programs intended to compensate for the effects on cognitive development of poverty and discrimination has been debated for years. This paper will discuss several studies which have attempted to assess the long-term effectiveness of compensatory early childhood education programs. It is divided into six sections. First is a brief review of some early studies, based on more extensive reviews in Schweinhart and Weikert (1980) and Lazar and Darlington (1982). Next is a lengthy description of work done by the Consortium for Longitudinal Studies, a group which for the past seven years has directed a coordinated effort by several investigators to combine many small, independent projects into one large longitudinal study, and has conducted a meta-analysis of these projects. The Consortium's results will be described in detail in the third section.

The fourth section will present findings from the Perry Preschool Project, probably the best of the studies participating in the Consortium. The Perry Project is marked by an extremely sound experimental design, extensive follow-up, and low attrition. Most of its participants have been tracked through high school, and it is probably the best single study available. A causal model to account for the effects of preschool education has been empirically tested by the directors of the Perry Project; this model will be described.

Section five consists of a summary of an economic cost-benefit analysis of the Perry Project. Finally, the results of two recently reported longitudinal studies conducted by local school systems will be discussed.

I. Brief review of early studies

Compensatory early childhood programs were launched in large numbers in the 1960's as a result of several concurrent factors. First, psychological research (reviewed by Hunt 1961; Bloom 1964) suggested that early life experiences had a crucial effect on intellectual development. Second, the sociopolitical climate of the time was characterized by a strong national desire to solve social problems and boundless optimism in the power of social and educational programs to do so. Third, economic prosperity assured plenty of public funding for compensatory preschool programs, including one national effort, Project Head Start.

Early evaluations of local programs were encouraging (e.g., Klaus and Gray 1968; Deutsch 1971); it appeared that preschool education did in fact raise IQ scores, which were presumed to be a good predictor of school and life success. However, later studies of local programs found that initial cognitive gains disappeared a year or two after the end of the preschool program. The first national evaluation of Project Head Start (Westinghouse Learning Corporation and Ohio University 1969) concluded that the program did not produce lasting benefits.

Although the Westinghouse study was sharply criticized on methodological grounds (Smith and Bissell 1970; Campbell and Erlebacher 1975), there developed a consensus that early childhood intervention had at best only modest and temporary effects on cognitive development, especially as measured by IQ scores (Chronbach 1969; Jensen 1969). This belief led to funds for federally sponsored programs being frozen so the programs could not expand. The prevalent attitude became, "Well, we tried, but it just doesn't have any effect."

II. The Consortium for Longitudinal Studies

In recent years information concerning the long-term impact of early childhood education has become available as researchers continued to keep track of and periodically measure students who had participated in the early studies. Most of these studies were small and locally funded, with no coordination of research designs and little contact between staff members of various projects.

In 1975 Irving Lazar and Edith Grotberg of Cornell University conceived the idea of a central pooling of data from the most methodologically sound of these early studies, along with a coordinated effort to collect new data on the participants as they progressed through childhood and adolescence. Lazar and Grotberg organized the Consortium for Developmental Continuity (later renamed the Consortium for Longitudinal Studies), an association of investigators representing eleven early childhood education programs with experimental or quasi-experimental designs, detailed preprogram data on children's intellectual ability and family backgrounds, and extensive followup information. Because of the diversity, depth, and high quality of these studies (Consortium for Longitudinal Studies 1979), the most recent Consortium report (Lazar and Darlington 1982) will provide most of the information for this review.

The projects in the Consortium were either center based, home based, or had both components. The subjects ranged from three months to five years old upon entering the programs, which lasted from one to five years. The samples were at least 89% Black, except one which was 65% Black. All families in all the projects had very low socioeconomic positions and low levels of parents' education. The range of the mean pretest IQ's (in those samples which measured it) was 79 to 94. Figure 1 contains a list of member programs and some of their characteristics.

The data analyzed and reported by the Consortium were gathered in three waves: (a) preprogram data were collected independently by the various projects; (b) postprogram data were collected independently by the projects when the children were from 3 to 10 years old, before the formation of the Consortium in 1976; (c) collaborative Consortium data were collected in 1976, when subjects were from 9 to 19 years old.

Although the projects were completely independent of each other before the formation of the Consortium, a common pool of data collected by a majority of the projects was found, including Stanford-Binet IQ test scores, Peabody Picture Vocabulary Test scores, academic achievement test scores, and demographic data.

Coordinated data collection began in 1976 and included information concerning school competence (i.e., retention in grade and/or assignment to special education), developed abilities (achievement and intelligence tests), achievement orientation, self-evaluation, maternal satisfaction with children's school performance and maternal aspirations for children.

The effect of pooling outcomes from eleven studies which were conducted completely independently of each other is to allow a very high degree of confidence in the results. All experiments or quasi-experiments conducted in real-world "laboratories" have some methodological weaknesses, and one can therefore question the validity of any one result. But specific weaknesses tend to differ from study to study, and thus tend to cancel each other out in a group of independent projects. For example, if one project has methodological flaw A but is free of flaws B and C, another has B but is free of A and C, and a third has C but not A or B, and all three projects show similar results, it is hard to attribute those results to flaws A, B or C. One can therefore more assuredly conclude that the results were valid.

III. Findings of the Consortium

Perhaps the most important outcomes found by the Consortium concerned successful progress in school, as measured by rate of special education placement and retention in grade. Of the six projects which were able to assess rates of special education placement, the median rate was 13.8% for children who had preschool and 28.6% for children who did not. Retention effects are very consistent but not as large. Eight studies measured retention; the median grade retention rate was 25.4% for children with preschool exposure, 30.5% for controls. These differences are very reliable statistically; further, they are of such magnitude that they have large practical significance as well, given the monetary costs of special education and retention. A cost-benefit analysis of one of the Consortium projects (Weber, Foster, and Weikart 1978) showed that the savings from reduced special education and retention costs alone enabled the project to pay for itself. Weber et al.'s economic analysis is extremely important and will be discussed in more detail in a later section of this review.

Achievement test results were not as striking but still indicate preschool effects after four to seven years. There were sufficient data for comparison at grades 3-6. Seven of the eleven projects in the Consortium contributed achievement data, most at more than one grade. Of the 19 comparisons in math achievement test scores, 16 favored the children who had had preschool experience. When results were pooled at each grade, preschool children's scores were significantly higher at grades three, four, and five. In reading tests, 17 of 20 comparisons favored preschool groups, although pooled results showed that only the third-grade difference was significant.

The authors of the most recent Consortium report (Lazar and Darlington 1982) believe that the Ypsilanti Perry Preschool Project has the most reliable data, because the achievement tests were administered by project personnel, the same test battery (California Achievement Test)

was administered to all children at each testing period, and their sample lost very few subjects over the years. This project found reliable preschool effects at every grade and, through eighth grade, preschool-control differences increased over time on reading, math, and language subtests (Schweinhart and Weikart 1980).

IQ scores showed very strong short-term effects but these did not last; by 1976 (ages 10-17), the last year of IQ data, most Consortium projects showed no program-control differences.

The Consortium reported on three measures of subjects' achievement orientation: attitudes toward the self, occupational aspirations, and educational expectations. The strongest finding was for positive attitudes toward the self that were linked to achievement. When asked to describe something they had done that made them feel proud of themselves, children with preschool experience were more likely than controls to give achievement-related answers. There were no differences in the other two measures.

The Consortium found two other areas of program impact: older students (aged 15-19) rated their own school performance higher than controls, and mothers whose children participated in early education programs reported themselves as more satisfied with their children's school performance than were mothers of control children, even after the students' actual performance was statistically controlled. The last finding may indicate a positive evaluation set toward their children as learners.

IV. The Perry Preschool Project

Probably the best single study of the effectiveness of early childhood education is the Perry Preschool Project, conducted in Ypsilanti, Michigan with children born each year between 1958 and 1962 (Schweinhart and Weikart 1980). It studied 123 Black children selected on the basis of their parents' low educational attainment and occupational status and their own initially low cognitive ability. For each year of the program studied (1962-1966) children were assigned to the experimental (preschool) group or the control (no preschool) group so as to equate the groups on initial cognitive ability, socioeconomic status, parents' education, and many other characteristics. Children in the experimental group attended a group preschool program for 1½ hours a week and, with their mothers, were visited at home 1½ hours a week. The first "wave" of children participated for one year, while waves two through five had two years of preschool. Extensive followup information concerning these children is now available through age 15, and some information through age 19. This study merits particular attention because of its strong experimental design and extremely low attrition rate. Its results will therefore be described in some detail:

1. Preschool education improved children's cognitive ability (IQ) during preschool, kindergarten, and first grade. IQ's of the experimental and control groups were equivalent by the end of second grade and thereafter.

2. Children who had preschool education showed increased motivation during elementary school. At age 15, these children placed a higher value on schooling, had higher aspirations for college, showed more willingness to talk to parents about school, spent more time on homework, and had a higher self-rated school ability than the control group.
3. As mentioned above in connection with the results from the Consortium for Longitudinal Studies, the Perry Preschool Project found reliable preschool effects on achievement test (CAT) performance, and the differences between experimental and control groups were larger at age 14 (the latest reported) than at any previous time. Moreover, the experimental group attempted more items on the test -- evidence of increased task persistence. This may partially explain the fact that there were achievement test differences but not IQ differences at age 14; IQ performance is not as dependent on the degree of self-imposed attention and persistence of the test-taker.
4. Records concerning school placement through grade 12 were available at the time of the most recent report of the Perry Project (Schweinhart and Weikert 1980); these show that, as was also true of the Consortium studies as a group, children with preschool experience are placed in special education settings at a much lower rate than children without preschool. By the end of high school, 39% of the control group had received special education for one year or more, compared to only 19% of the preschool group.
5. Preschool education led to improved classroom conduct and improved personal behavior, as rated by elementary school teachers when the children were 6-9 years old; it also led to a decrease in self-reported delinquent behavior when the children reached age 15.
6. Finally, in the latest, incomplete report on Project data, Pifer (1982) reports that 55% of the control group and 35% of the experimental group dropped out of school before graduating. In sum, the Perry Preschool Project apparently had significant positive impact on its participants' educational careers, from the beginning of the program to the end of the high school years.

A statistical technique called path analysis was used by the directors of the Perry Project to elucidate the causal mechanisms by which the preschool experience had its effects. They summarize the model as follows:

Preschool education leads to increased commitment to schooling and increased cognitive ability at school entry (the latter after the effect of cognitive ability prior to preschool has been taken into account). Family socioeconomic status, even though . . . unrelated to cognitive ability within this sample, is still an antecedent of school achievement. Cognitive ability at school entry is indeed

a gateway to better school performance, with a higher cognitive ability at school entry leading to greater commitment to schooling, higher school achievement and fewer years spent receiving special education services. Commitment to schooling and fewer years in special education combined in leading to fewer delinquent offenses. . .

(Schweinhart and Weikart 1980, p. 64)

V. Economic cost-benefit analysis of the Perry Preschool Project

Cost-effectiveness is an important consideration concerning preschool education, particularly in light of today's conservative economic climate. Even programs shown to be educationally effective may have trouble getting continued funding if the public believes they are not worth the monetary expense. Although some would argue that adherence to the ideal of equal opportunity compels funding of compensatory education programs even if they result in a net monetary loss, proven cost-effectiveness clearly could do nothing but help these programs gain continued legislative support.

Weber, Foster, and Weikart (1978) conducted an economic analysis of the costs and benefits of the Perry Preschool Project and found that the projected benefits outweighed the costs over the working lifetime of the children involved. The undiscounted benefits of two years of preschool education in 1979 dollars were \$14,819 per child against a two-year program cost of \$5,984 per child - a 248 percent return on the original investment. This estimate is somewhat misleading since it makes the unrealistic assumption that the money would have provided no return had it not been invested in preschool education; to correct for this, Weber et al. (1978) calculated the internal rate of return for the project and determined that investment in one year of preschool education was equivalent to an investment receiving 9.5% interest over several decades; the comparable rate for two years of preschool was 3.7%. Moreover, this is quite likely a conservative estimate, because it assumed there would be no inflation between 1979 and 2026 and also assumed that the experimental and control groups would drop out of school at an equal rate, when actually the dropout rate for the preschool group turned out to be much lower (Pifer 1982).

Costs incurred included public (salaries, supplies, building maintenance) and private (mostly clothing) costs. Benefits included mother's released time while the child attended preschool, money saved by the public schools because children with preschool had fewer years in special education or retentions in grade, and increased projected lifetime earnings. The last factor accounted for 73% of total benefits. Again, this is likely a conservative estimate because, in the absence of contrary evidence at the time, Weber et al. (1978) based these projections on equal dropout rates.

VI. Two recently conducted local studies

Recently two public school systems have reported long-term outcomes of local early childhood programs. The Philadelphia Public Schools compared California Achievement Test scores of former participants of four separate preschool programs with those of all students in the city (Philadelphia Board of Education 1982). Philadelphia's Head Start

program served exclusively poverty-level children, yet its graduates in 1981-82 exceeded national norm expectations (that is, more than 50% scored at or above the 50th percentile) at kindergarten through third grade in mathematics and kindergarten through second grade in reading. Head Start graduates equalled or exceeded the scores of the comparison group (essentially the entire city, with a much broader range in socioeconomic status) across grades 1-7, except kindergarten mathematics. This pattern was repeated among graduates of Get Set Day Care, another preschool program serving mostly low-income students.

These findings are somewhat difficult to interpret, because the comparison group differs to an unknown degree from the prekindergarten groups. The authors report that the SES range of the comparison group was great while the preschool groups were uniformly low SES, therefore the equality of the groups' test scores through seventh grade is evidence of the success of the programs. This is a reasonable interpretation; nevertheless, we don't know the magnitude of the difference in SES, nor do we know what percentage of the comparison group was higher in SES than either of the preschool groups.

Nieman and Gastright (1981) reported an eight-year followup study conducted in the Cincinnati Public Schools which varied the amount of preschool education. One of the two groups compared attended all-day kindergarten while the other attended half-day kindergarten. Some of each group had attended preschool, although the proportions differed; 89% of the all-day-K group and 60% of the half-day-K group had preschool experience. Combining these two variables, then, the average member of the all-day-K group had received more prefirst-grade education than the average member of the half-day-K group.

The students did not differ on a locally developed pretest administered in the fall of kindergarten and were all in Title I schools when the study began. Testing was done in the middle (Boehm) and end (MRT) of kindergarten, and repeated in the spring of grades 4 and 8 (MAT). Substantial differences were found on all subtests of the Boehm and on reading and math total scores on all other tests through grade 8. Fewer members of the all-day-K group had repeated a grade or been placed in special education by the end of eighth grade.

CHARACTERISTICS OF EARLY EDUCATION PROGRAMS AND AGES OF SUBJECTS FOR EACH DATA SET

Principal Investigator	Project Name and Location	Delivery System	Birth Year	Age at Entry	Program Length	Years of Program
Beller*	Philadelphia Project, Philadelphia	Center	1959	4 yrs	1 yr	1963-64
Deutsch	Institute for Developmental Studies, New York	Center	1958-66	4 yrs	5 yrs	1963-71 (8 waves)
Gordon/Jester	Parent Education Program, North Central Florida	Home	1966-67	3-24 mos	1-3 yrs	1966-70 (3 waves)
Gray	Early Training Project, Tennessee	Center/home	1958	3.8 or 4.8 yrs	14 or 26 mos	1962-65
Karnes	Curriculum Comparison Study, Champaign-Urbana, Ill.	Center	1961-63	4 yrs	1-2 yrs	1965-67 (2 waves)
Levenstein	Mother-Child Home Program, Long Island, N.Y.	Home	1964-68	2 or 3 yrs	1-2 yrs	1967-72 (5 waves)
Miller	Experimental Variation of Head Start Curricula, Louisville, Ky.	Center and center/home	1964	4 yrs	1 yr	1968-69
Palmer	Harlem Training Project, New York	Center	1964	2 or 3 yrs	1 or 2 yrs	1966-68
Weikart	Perry Preschool Project, Ypsilanti, Mich.	Center/home	1958-62	3 or 4 yrs	1 or 2 yrs	1962-67 (5 waves)
Woolman	Micro-social Learning System, Vineland, N.J.	Center	1966-68	4-5 yrs	1-4 yrs	1969-73
Zigler	New Haven Follow-Through Study, New Haven, Conn.	Center	1962-64	5 yrs	4 yrs	1967-71 (2 waves)

* Beller used a different designation of program group from the one shown here. In his own study, this group received 2 years of preschool while his second group received 1 year of preschool (i.e., kindergarten).

Figure 1. CHARACTERISTICS OF MEMBER PROJECTS OF CONSORTIUM FOR LONGITUDINAL STUDIES.
(From Lazar and Darlington (1972), p.6)

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